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Building automation with Bluetooth Mesh

The number of devices that need to be connected and to be able to communicate with each other is continuously increasing, and different applications require different radio technology: Wifi, Thread, and Zigbee have established themselves in building automation. With Bluetooth Mesh, the Bluetooth SIG launched their own radio standard in 2017 to enable connecting devices in a scalable network. In contrast to project work completed last semester, which focused on gathering know-how and testing on a small demo network, this Bachelor's thesis aims to implement a more practical network for building automation. To this end, a control system for a light application has been developed, which consists of a battery-powered remote to set the desired brightness, a sensor node to measure the current brightness, and an LED tube lamp that uses these two system components to control the brightness in the room.

Furthermore, a network scan functionality has been implemented that displays the current network topology on a webpage in order to allow the user to gather more information about the system. Additionally, a gateway has been developed to connect the new radio standard to the long-established and widely used KNX standard. With this device, it is possible to control KNX devices from the Bluetooth Mesh Network and vice versa. Using KNX, the integration of the open source project 'Home Assistant' was easily possible, which in turn allows a multitude of other protocols to be connected to our system.
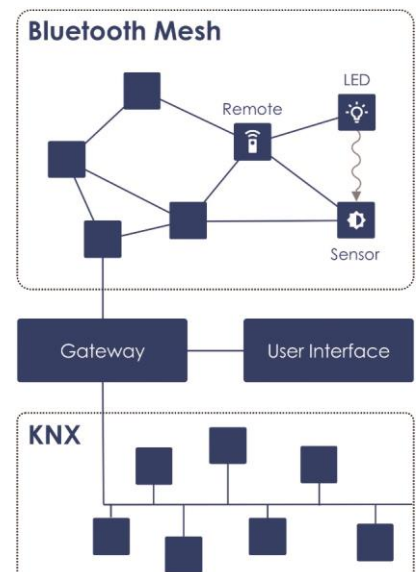
Various measurements using different setups were used in order to examine the behavior of the network in different situations (e.g. low and high density). One of the most important findings was that the nodes should not be placed randomly but need to be positioned strategically. Otherwise, the quality of service could suffer considerably.

All core functions of the system work as intended, which allows this project to be used as a foundation for future applications. A possible follow-up project is already being discussed, which would aim to commercialize the gateway used to connect KNX to a Bluetooth Mesh network.

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System overview