Home Occupancy Simulation Using Machine Learning

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Property theft is a prevalent social issue that plagues countless communities around the world. In 2022, over 6,500,000 cases of property crime nationwide were recorded, a 7.1% increase compared to 2021. This research is aimed at finding a smart solution to property theft using a Machine Learning (ML) algorithm that simulates and predicts home activity and occupancy by learning IoT devices' usage patterns in a building. Existing solutions are non-dynamic, relying on user-set automation schedules (Presence Simulator); time-consuming to create and difficult for users to employ; or may incite suspicion to anyone monitoring the home or building due to relying on randomized scheduling (OccuSim). However, this article proposes a Machine Learning based solution capable of simulating occupancy within a home or building using actual learned usage patterns normally present, recorded during the normal, day-to-day usage of a home. A custom Home Assistant build is used to manage IoT devices. Furthermore, Extreme Gradient Boosting (XGBoost) is used as the ML model to learn the IoT devices' behavior patterns and forecast them in the future due to the robustness of the algorithm as well as its efficiency and scalability. The system can currently work with various types of IoT devices such as LED Lights and smart TVs with relatively strong performance. By harnessing the power of ML and IoT, a well-performing property theft deterring system has been devised to contribute to the creation of safer communities and more secure living environments.

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