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Visible Light Communications for Indoor Applications

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ABSTRACT

Indoor localization systems have gained a large interest in the research area recently specially from companies. The localization process is the process of finding a target location and it can be used in many applications. These applications include location based services, tracking, private services, autonomous robot control and navigation assistance.

Although, global positioning system (GPS) provides good accuracy for outdoor localization, it cannot be used for indoor localization because its positioning error is in terms of few meters which is not accepted indoor. Other wireless technologies have introduced to be used in localization systems for example infrared (IR), radio frequency (RF), and ultrasonic (US). But these technologies suffer from many problems like electromagnetic interference, low accuracy, complexity, and high cost.

Visible light communication (VLC) is a new technology which has a lot of merits and can be used in many applications. It offers a simple cheap localization system which is characterized by high accuracy and low complexity. The main advantage of VLC is the ability to use already installed (light-emitting diode) LED lighting and providing dual functions illumination and communication. It is expected to be the dominant used technology in the future.

This thesis introduces new algorithms which are used for the first time with VLC-based localization systems and provides a high accuracy compared with the conventional methods. It takes into consideration Gaussian noise (thermal noise, and shot noise) and non-line-of-sight (NLOS) link with three bounces from plaster walls (high reflectivity 0.8).

Interpolation and regression with two different classes are investigated with received signal strength indication technique including linear and nonlinear least square methods. Besides, this thesis introduces an early calculation to consider diffuse power as a useful power and not as an error with providing good accuracy.