

LF Indoor Location and Identification System

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INTRODUCTION

ELSI (Electric Sensors with Intelligence) is a system which can be used to locate people and measure some vital parameters. For the measurement, sensor elements placed under the floor surface are used. A low frequency low voltage signal is fed to a single sensor element. The others provide the return path for the signal. Any conductive object in the vicinity of the sensor affects the impedance. Thus the person can be located (Fig. 1) [1].

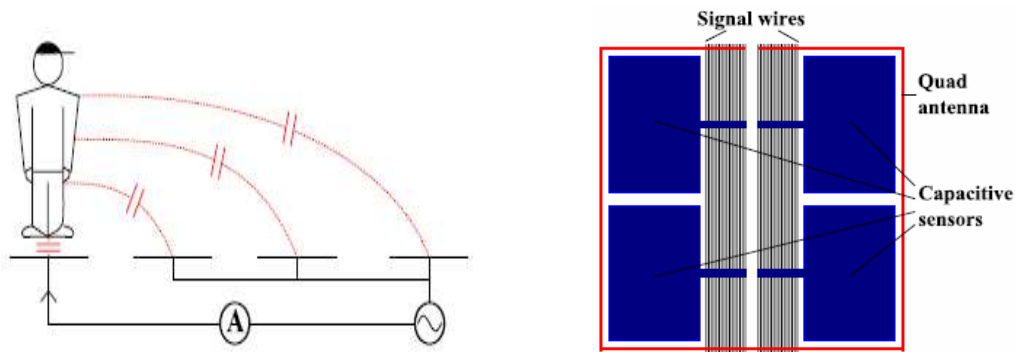


Fig. 1. The current flow of a single element is affected by a person. The whole element matrix is scanned sequentially.

Fig.2 A schematic picture of an ELSI sensor element. Quad antenna surrounds the electric field sensors and signal wires

THE RFID-SYSTEM

The system presented here is to add the identification function to the ELSI system. The solution is a system illustrated in fig. 3. Each quad antenna is sequentially fed with a coordinate specific code (LF-path). The tag transmits the coordinate and a tag specific ID to the system (HF path).

Usually transmitted signal in indoor location system is refracted and reflected from the walls and objects which also absorb the signal [2]. Use of the low frequency minimizes the disturbances because of the near field condition.

A prototype system was constructed to verify the feasibility and functionality of the planned RFID concept. A limited range low frequency magnetic field is created sequentially by each quad antenna. The Transceiver Unit sends a unique code to each

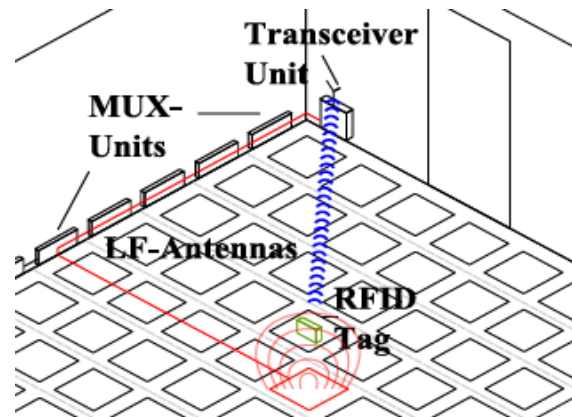


Fig 3. ELSI-RFID routing. Low frequency signal goes through MUX-units and induces magnetic field in selected quad antenna. Tag responds to the system with HF-signal (small curved lines). Grey lines: borders of different ELSI-element carpets.

antenna using multiplexers (MUX-units). When the unique code of an antenna is detected by a tag's LF channel it relays the code and its own ID-number to the Transceiver Unit using the HF channel. Thus the tag can be both identified and located. LF channel works with 100 kHz and HF channel frequency is 2.4 GHz. Theoretical bit rate with 100 kHz carrier frequency using ASK-keying is about 10 kb/s [3]. In actual systems the rate is below 4 kb/s. However the rate is enough to send short location messages. For example with 8 bit address space it takes about 200 ms to go through all 256 antennas.

DISCUSSION

The simple prototype showed that it is possible to build a location system with floor's quad antennas. The next step is to use the MUX-unit LF-data rate up to 4 kbit/s. There is also work to create a network and controlling system that would bond the rooms with ELSI-RFID together wirelessly. At the moment ELSI uses CAN (Controller Area Network) to connect the rooms with the central unit [1].

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