Abstract

In this experiment, a platform for localizing patients in a restricted area was designed and build. The platform used both short and long-range measurements in order to localize a patient who is wearing a wireless badge. A proximity sensor mounted on a servo motor was used to do the short-range positioning. The long-range position of the patient was obtained using the received signal strengths between different wireless links and the patient’s badge. A tracking algorithm was developed to merge the short and long-range measurements. The patient’s coordinates were displayed on the LCD of the STM32F429 Discovery board.

LCD Theory

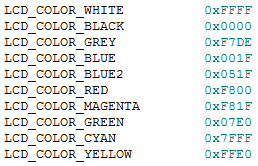
The STM32F429 Discovery Board packs a LCD (liquid-crystal display) whose pixels are mapped to a subset of the board’s RAM. The LCD resolution is 240 by 320 pixels. Using the provided LCD library, it is possible to draw lines, rectangles, circles, polygons and write texts at specific lines. Those shapes and texts can be displayed in the colors listed in Figure 1 using the associated codes.

Figure - The available LCD colors and their codes

It is also possible to display numerical pictures (in JPEG, BMP, PNG or GIF format) by hardcoding every pixel of the pictures in the code. A tool named STMImager has been created for that purpose.

The LCD has two visible layers, the background and the foreground. It is possible to adjust the transparency of the layers to create different effects. Different texts and drawings can be displayed on different layers. This makes it easy to create nice animations.

LCD Implementation

The representation of the patient’s location

Two metrics are available to determinate the patient’s coordinates: its numerical coordinates and its position on the map.

The numerical coordinates

The patient’s location is represented on a 2-axis Cartesian system. As seen on Figure 2, these numerical coordinates are written on the top part of the display. They are rewritten using the LCD\_DisplayStringLine function every time the function updateCoords is called.

The map

In order to display the position of the patient in real time, the LCD was used extensively. The first step was to display a map where the position of the patient would be shown. The map consists of a gridded square of 240 by 240 pixels displayed at the bottom part of the LCD as seen on Figure 2. The square was drawn using the LCD\_DrawFullRect function. To make the grid, horizontal and vertical lines were drawn using the LCD\_DrawLine function repeatedly. The map was drawn on the background layer, in order to make it easy to draw and erase patient’s positions on the foreground layer while not having to redraw the whole grid. The map only needs to be drawn once at the initialization. The patient’s position is represented by a white circle that is redrawn every time the function updateCoords is called.