D4.4.1
Interactive Mat Development & Integration

Work package	**WP4 Play Suite Development & Integration**
Task	**T4.4 Interactive Mat Development & Integration**
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Project PLAYTIME

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1 Executive Summary

The interactive mat was developed with the objective to provide methods for engagement in a social group in playful interaction with an intelligent board game – being played on the floor or on a table.

Objects of the game are connected to the front-end and back-end by means of Bluetooth connectivity and act in terms of internet-of-things functionality by use of ninepins with active sensing, pressure sensors for interaction pattern logging and analysis, and the intelligent interaction engine of the mat.

In the context of game status, the back-end triggers personalised training units and playful engagement in the group.

In this Task and in the context of this PLAYTIME Deliverable serious D4.4.1 – D4.4.3 a basic description of the functionality of given technology is provided (D4.4.1) as well as an outlook on future technological trajectories in the face of emerging technologies (D4.4.2, D4.4.3).

2 Interactive Mat Components

2.1 Backend Server Specifications

The interactive mat (IM) provides a real world multi-sensory playing field with a wireless interface to a mobile app. The IM has a playful game design with cheerful graphics, colored cones one each for a player, an electronic dice and tens of playing fields.

Each playing field is equipped with RFID (radio-frequency identification) tags and each cone with a RFID reader to get the current position of each cone on the IM. The cones send these positions to the mobile app via a Bluetooth interface, same as the dice sends the current number of dots rolled.

In a previous version of the IM (Austrian national project AktivDaheim), the IM was equipped with a LED matrix on its intermediate layer which was used to illuminate certain playing fields. The LED matrix was also controlled by the app, which could illuminate playing fields in certain colors. In addition, other playing fields can be illuminated to add more tasks when players end on these playing fields.

Players move their cone based on a game logic according to the dice roll. Different game modes can be selected on the mobile app. This combination of different tasks aided by a multi-sensory mat and a mobile app control center provide a playful group activity for dementia training.

The interactive mat developed in PLAYTIME will be based on a previous version that was developed in the Austrian national R&D project “AktivDaheim”. However, it will be adjusted in its graphical design and be disseminated in two versions, (i) one with the RFID tags and (ii) one without any tags for easy transportation and in a cheap solution without cones.

2.1.1 System Requirements

The basic requirements for the development of an interactive mat with board type serious game were defined in workshops and are listed below, as follows:

- Simple use in transportation by dementia trainers.
- Short time needed for the installation in the home of the person with dementia.
- Materials should not be highly sensitive to weight and pressure.
- Interactivity: information flow should at least be in the direction from mat to the tablet PC.
- Energy consumption should be minimal.

Figure 1. Interactive Mat developed by FAM already in the first version PLAYTIME design.

Following the technical considerations for the implementation FAM defined the following specifications:

- The board of the mat should be variable in size.
- Persons should be able to walk on the board without any constraints.
- The cone must be very easy to handle.
- Information about the field where the cone of a person is located will be communicated via RFID sensors.

2.1.2 RFID (NFC) Sensors

The radio frequency identification (RFID) technology is already part of several application fields of daily life, for example, for contact-less bank card payments. The RFD reader and the passive RFID tags (without battery) are communicating within short distances using an electromagnetic frequency and data exchange of about 13.56 MHz. This so-called near-field communication (NFC) works across most metal materials and can receive signals with up to 10 cm distance.

NFC readers have to be attached to a micro-controller and can be connected via a Bluetooth 4.0 sending device to other interfaces. The microcontroller reads the positon of a NFC tag and sends this id and with it the actual position via the Bluetooth 4.0.

NFC tags can be attached and implemented into a mat design and can store the position of each playing field. The microcontroller unit with FC reader can be implemented into a playing cone and be attached as close as possible to the playing board.

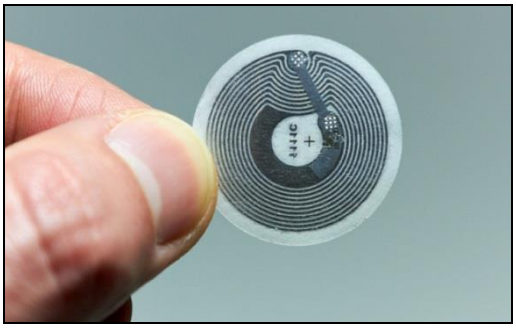

Figure 2. Typical passive RFID tag.

The price of an NFC tags is cheap, i.e., about 50 Cents. A potential prototype can be developed with costs of approximately 200 € for each cone.

2.1.3 Cone for the interactive mat

The cones for the board game should consist of a specific covering plastics material and with built-in sensors, reader and transmitter. For the localization on the mat a NFC technology will be applied. Power supply of the cones will be performed with a specific accumulator technology.

Figure 4 displays a detailed sketch of a single cone component. The microcontroller will include the following components:

- Complete electronics for the interpretation of the position of an NFC tag on the mat,
- Interface for the transmission of Bluetooth 4.0 data,
- Power loading electronics,
- Switching logics.

The antenna for the reading of the NFC signals is at the bottom of the cone. The whole electronics will be attached to a central pole which can be dispatched easily. The status of the battery can be read with a LED and a button outside can be used to switch on and off the electrics of the cone.

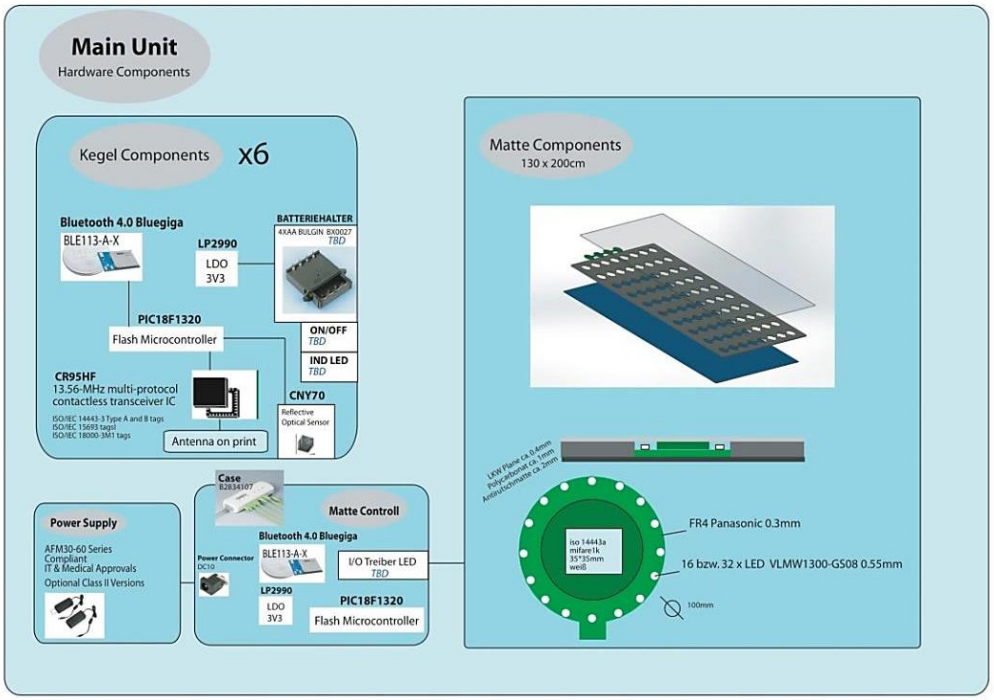

Figure 3. Interactive mat details. The mat includes LED configuration which will not be implemented in PLAYTIME but which is easily augmented to the design in future projects.

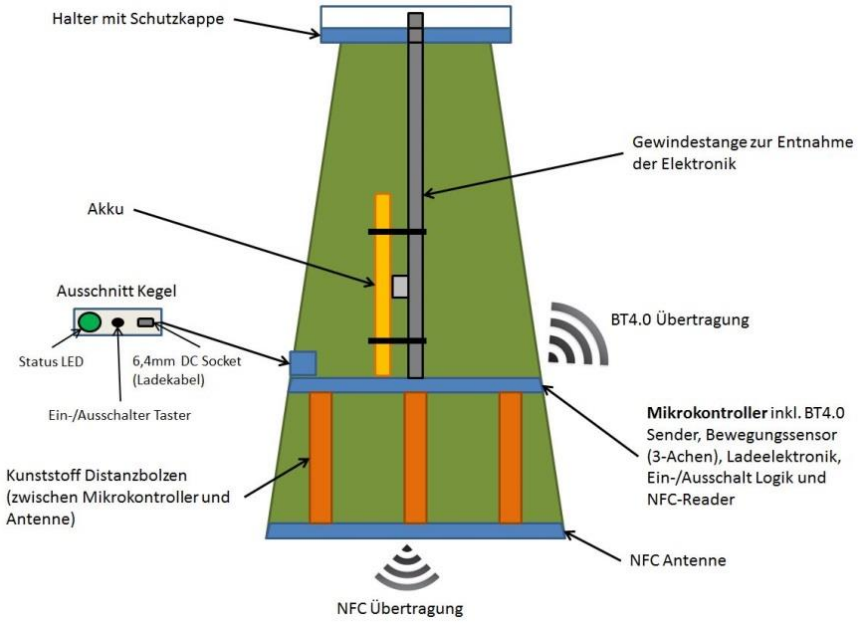

Figure 4. Schematic diagram of a single cone.

2.2 Further development and considerations

Figure 5 depicts a characteristic scenario with the board game as it is played with the latest version of amicasa. It is played as a multi-user game and the state of play is simply input into the Tablet PC in order to enable personalisation of further interactions.

In the PLAYTIME project, the board game will be played in groups at the care home, as well as in small teams at the home of the PwD. It has been agreed with the funding organization that there will be no specific development in PLAYTIME during project time, however, the task will be used to analyse the validity of the social aspects of playing together and provide data for the multimodal analytics, see PLAYTIME Deliverable D3.5.1

Figure 6. The board game as played with the latest version of amicasa. It is played as a multi-user game and the state of play is simply input into the Tablet PC in order to enable personalisation of further interactions.

3 Conclusions and Outlook

This PLAYTIME Deliverable presented an overview on the development of the interactive mat technology as input to the PLAYTIME project.

The outlook on the next PLAYTIME Deliverable in this Task, i.e., Deliverable D4.4.2 emphasises on observations on emerging technologies that would project into future developments of the interactive mat technology in the context of mental health applications.

4 Abbreviations

Table 1. Abbreviations.

Abbreviation	Description
PwD	Person with Dementia