Prototyping Connected Tangible Interactions with Kniwwelino

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ABSTRACT
This workshop will introduce Kniwwelino, a new Arduino compatible microcontroller platform, supporting the electronic prototyping of interactive and connected objects. Kniwwelino provides sensors and actuators encapsulated with Wi-Fi functionality, made easily accessible through a specially developed Arduino library. The workshop is designed as continuation of workshop 2, dedicated to the actual implementation of the previously elaborated ideas. Aim is to explore the possibilities and limitations of the platform for prototyping tangible interaction enabled IoT projects.

Author Keywords
Physical computing, Tangible User Interfaces, Internet of Things, Prototyping

INTRODUCTION
Prototyping methods play an important role in the design of tangible user interfaces. Since the tangible design space offers a wealth of opportunities, intermediate prototypes are commonly used to rapidly iterate between options, collect feedback from users, and identify quickly mistakes [4,5].

In the past years, many low-cost electronic development platforms have become available on the market (e.g. [2,3]). Aim of these platforms usually is to support users without knowledge in electronics in exploring design solutions that make use of various alternative sensors and actuators.

However, most of the available boards provide pure processing power. To be able to connect the device to the Internet additional hardware needs to be added, requiring advanced skills in electronics and software. Other boards like the BBC micro:bit or the Calliope mini come with Bluetooth Low Energy (BLE) which needs additional hardware like mobile phones or PC to connect them to the Internet.

The group of Wi-Fi enabled development boards consists of the ones that come with a Wi-Fi hardware in addition to the microcontroller and the ones which integrate the Wi-Fi into the microcontroller as so called System on a Chip (SoC). In the last group the ESP8266 has to be highlighted as it is very popular in the Maker scene, because there is a brought support in different programming languages like Arduino, Lua, Micro Pyhton, etc.

With Kniwwelino, we seek to provide a low-cost development platform providing easy access to IoT functionalities, such as sending and receiving sensor values over lean message based communication protocols. Furthermore, Kniwwelino should be sufficiently small to be integrated in any type of object and provide easy to use extensions with the related software libraries.

KNIWWELINO
The Kniwwelino hardware consists of a 5x5 LED matrices, a RGB LED and two push buttons. There are additional ports that can be used to extend the board by additional sensors and other peripherals. The underlaying micro-controller platform is also embedding a Wi-Fi stack. That enables the Kniwwelino to connect itself to other Kniwwelino's over the Internet. By implementing standard IoT message protocols, like MQTT it could be easily be integrated in existing IoT installations. The small size of the printed circuit board makes it possible to embed the Kniwwelino in nearly every crafted enclosure or object to not limit the development of the child's creativity.

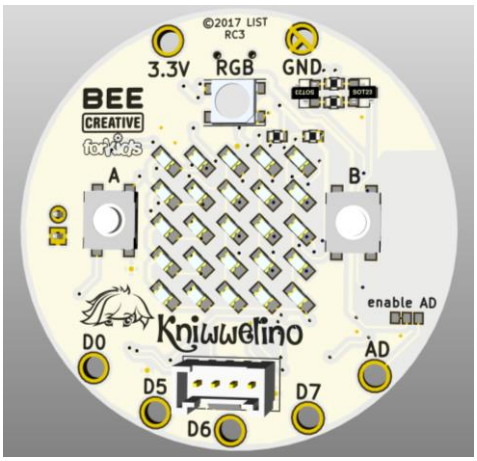

Figure 1. 3D Rendering of the Kniwwelino

WORKSHOP DESCRIPTION
Aim of the workshop is to explore the possibilities and limitations of the Kniwwelino platform for prototyping tangible interaction enabled IoT projects.

The workshop is designed as a continuation of the workshop "Interaction with the Internet of Tangible Things (IoTT)" [1] and will first give an introduction on how to setup the Arduino IDE to work with the Kniwwelino. After a quick walk-through of the Kniwwelino library functions, showing how to use the core functionality, we will start to develop

concepts in small groups how to implement a first functional prototype from the paper designs developed in the previous workshop. Workshop participants will then implement the concepts in software, as well as embed the hardware into a cardboard prototype.

In the end of the workshop each group will present their prototype to the audience. The workshop finishes with a discussion on the encountered problems and identified opportunities.

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