

POZNAŃ UNIVERSITY OF TECHNOLOGY

FACULTY OF CONTROL, ROBOTICS AND ELECTRICAL
ENGINEERING

INSTITUTE OF ROBOTICS AND MACHINE INTELLIGENCE

DIVISION OF CONTROL AND INDUSTRIAL ELECTRONICS



MOBILE APPLICATION
PAPER PROTOTYPING

MOBILE AND EMBEDDED APPLICATIONS FOR
INTERNET OF THINGS

TEACHING MATERIALS FOR LABORATORY

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I. GOAL

KNOWLEDGE

The aim of the course is to familiarize yourself with:

- concept of paper prototyping,
- tools and techniques used in paper prototyping.

SKILLS

The aim of the course is to acquire skills in:

- designing graphical user interfaces of mobile applications,

SOCIAL COMPETENCES

The aim of the course is to develop proper attitudes:

- strengthening the understanding of the role and application of network communication in IT systems and related security issues,
- strengthening understanding and awareness of the importance of non-technical aspects and effects of the engineer's activities, and the related responsibility for the decisions taken,
- proper technical communication in context of software development,
- choosing the right technology and programming tools for the given problem,
- analyzing technical problem from *user* point of view.

II. LABORATORY REPORT

Complete [laboratory tasks](#) as per the instructor's presentation. Work alone or in a team of two. **Keep safety rules while working!** Prepare laboratory report documenting and proving the proper execution of tasks. Editorial requirements and a report template are available on the *eKursy* platform. The report is graded in two categories: tasks execution and editorial requirements. Tasks are graded as completed (1 point) or uncompleted (0 points). Compliance with the editorial requirements is graded as a percentage. The report should be sent as a *homework* to the *eKursy* platform by Sunday, April 18, 2021 by 23:59.

III. PREPARE TO COURSE

A) KNOW THE SAFETY RULES

All information on the laboratory's safety instructions are provided in the laboratory and on Division website [1]. All inaccuracies and questions should be clarified with the instructor. It is required to be familiar with and apply to the regulations.

Attend the class prepared. Knowledge from all previous topics is mandatory.

B) INTRODUCTION TO PAPER PROTOTYPING

Paper prototyping is a widely used method in *user-centered design*, a process that helps developers create software that meets user expectations and needs - in this case, especially for designing and testing **graphical user interfaces** (GUI). This is one-time prototyping and includes the creation of rough or even hand sketched interface drawings to be used as prototypes or design models. While prototyping on

paper seems straightforward, this usability testing method can provide useful feedback to help design easier-to-use products [2].

For paper prototyping, one can use - as the name suggests - *pen and paper*, as well as a wide range of graphic design programs (graphic editors). However, there are also dedicated tools for designing user interfaces - such as the Marvel App for mobile applications [3].

IV. SCENARIO FOR THE CLASS

A) TEACHING RESOURCES

- Hardware • computer,
 • pen and paper.
- Software • *any* graphics editor,
 • dedicated tool for prototyping mobile applications (e.g. Marvel App).

B) TASKS

Design a graphical user interface for a mobile app for the Sense Hat board.

1. Design a graphical interface presenting to the user data from *sensors* and *user inputs*.
 - (a) The interface should contain a *dynamic* list or table with the available measurements (e.g. angular orientation (RPY), temperature, pressure and humidity from the Sense Hat add-on) and the status of the user inputs (e.g. the three counters (XYC) of the joystick from the Sense Hat add-on).
 - (b) Each element of the list / table should contain information about the name of the measurement or input and its current state with the unit.
 - (c) The list / table may contain additional information about the measurement or input (ID, range, timestamp, etc.). Remember that, for example, the temperature on the Sense Hat board can be measured by two different sensors.
2. Design a graphical interface containing chart with several measurement quantities expressed in the same physical unit.
 - (a) The interface should contain timeseries plots of several measurement quantities varying within the same range and expressed in the same physical unit, e.g. angular orientation (RPY) from the Sense Hat add-on.
 - (b) Put on the chart all the necessary information for the correct and unambiguous interpretation of the data.
 - (c) Take into account the properties of mobile devices: limited screen sizes and the ability to dynamically change the orientation.
3. Design a graphical interface containing chart(s) with several measurement quantities expressed in different physical units.
 - (a) The interface should contain timeseries plots of several measurement quantities varying in different ranges and expressed in different physical units, e.g. temperature, pressure and humidity from the Sense Hat add-on.
 - (b) Put on the chart all the necessary information for the correct and unambiguous interpretation of the data.

- (c) Take into account the properties of mobile devices: limited screen sizes and the ability to dynamically change the orientation.
- 4. Design a graphical interface presenting the state of user inputs in a graphical form.
 - (a) The interface should contain a graphical presentation of the state of user inputs, e.g. the counters of the joystick from the Sense Hat add-on in the form of a point position on the XY plane or a bar graph showing the state of the encoder, pairs of buttons, potentiometers etc.
 - (b) Put on the chart all the necessary information for the correct and unambiguous interpretation of the data.
 - (c) Take into account the properties of mobile devices: limited screen sizes and the ability to dynamically change the orientation.
- 5. Design a graphical interface to control the user output.
 - (a) The interface should allow setting the state of all available user outputs (e.g. the LED matrix from the Sense Hat add-on).
 - (b) The interface should clearly communicate whether the current user settings correspond to the output states (i.e. whether the user has applied the last changes).
- 6. Design a graphical interface containing the mobile application configuration menu.
 - (a) Suggest a list of configuration parameters available to the end user and developer / tester, e.g. IP and server port, sample time(s), error log file path, API version, maximum number(s) of measurement samples, etc.
 - (b) Design an interface that allows you to edit the proposed parameter list.

NOTE: If you plan to complete the final task with a different embedded system than the Sense Hat board, you can design 6 similar graphical interfaces for *your* target system. In this case, consult the tasks specifications with the instructor before submitting the report.

REFERENCES

1. *Regulations, health and safety instructions* [online]. [N.d.] [visited on 2019-09-30]. Available from: <http://zsep.cie.put.poznan.pl/materialy-dydaktyczne/MD/Regulations-health-and-safety-instructions/>.
2. Paper prototyping. In: [online]. 2020 [visited on 2021-04-03]. Available from: https://en.wikipedia.org/w/index.php?title=Paper_prototyping&oldid=993560826. Page Version ID: 993560826.
3. *Marvel - The design platform for digital products. Get started for free.* [Online] [visited on 2021-04-03]. Available from: <https://marvelapp.com/>.