DREEM

Designing use**R** centric **E**-kickscooters & business models for **E**nhancing inter**M**odality

DELIVERABLE NUMBER: **D4 (D2.1)**
DELIVERABLE TITLE: **DREEM e-kickscooter 1st release**

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Main author(s)	Marco Girotto
Contributors	
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MAIN COORDINATOR

Name	Federico Galliano
Organisation	PUNCH TORINO SPA
Address	Corso Castelfidardo 36, 10129 Torino, Italy
E-mail:	federico.galliano@punchtorino.com

CONSORTIUM PARTNERS

No	Organisation	Country	Acronym
1	Punch Torino	Italy	PUNCH Torino
2	Elaphe Pogonske Technologije Doo	Slovenia	ELAPHE PROPULSION TECHNOLOGIES LTD
3	Domel Elektromotorji in Gospodinjski Aparati D.O.O.	Slovenia	DOMEL D.O.O.
4	Three O'Clock	France	Three o'clock
5	5T SRL	Italy	5T
6	ICLEI European Secretariat GmbH	Germany	ICLEI
7	Bumpair	France	Bumpair
8	Goeteborgs Universitet	Sweden	UGOT
9	Tractebel Engineering	Belgium	Tractebel
10	TO.TEM Srl	Italy	TOTEM

ABSTRACT

Definitions of all component design and their features together with technical partners. Among these features there are: foldability, modular battery, 3 wheels, and in-wheel motor and helmet. The development will include also the electronic control module that will include the HMI (human machine interface), battery management systems and innovative connection with rear safety sensors (such camera or radar).

CONTENTS

WP2 - OBJECTIVES

WP2 aims at designing and releasing DREEM KS to be tested during pilots (WP3). The WP has 4 main sub-objectives for the realization of our light 3-wheels electric kickscooter:

- Prototype design and architecture
- Engine
- Helmet & safety features (sensors)
- User interface [DREEM App]. The approach is to work on different tasks focusing on a specific part of the vehicle and its usability. The common result will be a first version of both DREEM vehicle and APP released before WP3 pilots start

WP2 – DESIGN AND ARCHITECTURE

PROTOTYPE DESIGN – overview

Based on the design thinking activity performed by DREEM team the following key features have been identified as needed by users:

- Large front tire (10”)
- Improved stability and agility → Three-wheel solution has been chosen
- Puncture proof solution
- Large deck to have more space for feet and to drive with the feet in parallel
- Easiness to carry the scooter when not driven (best compromise among weight and portability)
- Additional safety sensor/camera to improve the level of safety during the ride

The following features instead have been identified as needed for the motor design:

- 350W motor, as compromise among performance and battery range
- Limited weight to ensure an overall vehicle performance in line with user expectations

The inflatable helmet solution should improve users’ safety by providing a self-inflatable system capable to be used in few minutes and several times. The final design (that will be available by the end of the project) will be studied to be integrated with the scooter design.

The user interface and experience with the scooter is based on:

- Commands on the handlebar: all commands need to be designed with the aim to be easy to be used and in the same time available without distractions for the driver

- Smartphone APP: when the smartphone is put on the smartphone support of the scooter all the driving information need to be reported. On top of that the user experience on using the APP need to be verified and tested. User interactions when using key App features like scooter dashboard, navigation system, collision alert system and other will be tested during pilots.

The deliverable described in this document has a demonstrator nature: for this reason we will report the key results of the investigations and evaluation done during the design for documentation completeness while the physical availability of prototypes (1st version) of DREEM scooters will be verified and showed at the start of Pilots operation.

PROTOTYPE DESIGN– MECHANICS AND ELECTRONICS

As it's possible to see in Img.1 DREEM scooter design is using a three-wheeler design, improving the stability of the vehicle. The choice of the two wheels in the rear side is due to the best compromise among vehicle dynamic, engineering complexity and then sustainability of the overall cost for manufacturer and final user (quality and aftermarket costs).

The rear axis is using a similar design of longboard skateboards trucks, ensuring to rear wheels the possibility to turn in the same direction of the road. Brakes are double (electric and mechanical with disc brake) to ensure the maximum safety level: in case one of the two not working the other is always available.

Fig. 1 - DREEM scooter 1st design - overall design

In the Fig. 2 we can see:

- The handlebar design: accelerator lever in the right side and brake lever in the left side. A ring bell is also available by default.
- Smartphone support: the personal smartphone can be put on the support. In this way the user can interact with the smartphone only when needed (starting the navigation system, being alerted in case of risky situations, verifying current speed, battery range and drive mode).
- Digital display in order to use the scooter also without the smartphone.

Fig. 2 - DREEM scooter 1st design – handlebar & smartphone support

Fig.3 shows rear view of DREEM scooter. A camera has been added to verify what happens behind the driver. This is adding a key safety feature into the scooter since in this way the driver can:

- See what happens behind in specific traffic conditions, like before turning. The feature is then providing an „Electronic mirror ".
- Being alerted in case of risky situations like a car or a bike approaching suddenly from behind. This system is based on an AI algorithm analysing the rear image, recognizing objects and tracking them.

Fig 3 - DREEM scooter 1st design – rear view

In Fig 4 the rear light and the turning indicator lights are shown

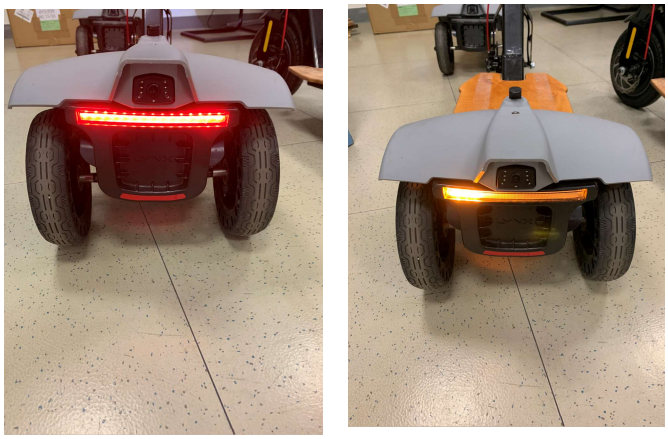

Fig 4 - DREEM scooter 1st design – rear view (lights and turn indicators)

PROTOTYPE DESIGN – FOLDABILITY

By engaging with users, a key pain point identified was the possibility to carry the scooter in an easy way when it's not possible to drive it.

The team worked on the possibility to provide a "suitcase-like" experience leveraging on the two wheels present in the rear side and an handlebar in the front side. In the Fig. 5 it's possible to see current prototype:



Fig 5 - DREEM scooter 1st design – foldability solution “suitcase-like” experience

PROTOTYPE DESIGN – HUB MOTOR DESIGN

For details about the motor design please check D2.3 (Hub motor design) and D2.4 (Bub motor prototypes).

The following is an overview of the technical details and activities performed:

HUB MOTOR HOUSING

Hub motor housing for prototypes were manufactures as per weight optimal CAD model, which included several innovative mass reduction features.


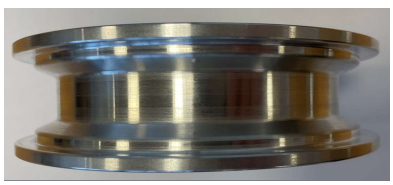
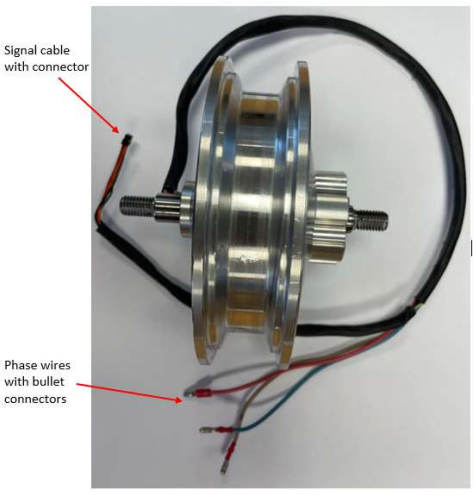

Figure 5: Complete HUB motor assembly.

Fig.6 – Hub Motor Design

Fig. 7 HUB motor integrated in e-kick scooter.

TRANSVERSAL FLUX MOTOR

Stator of transversal flux motor (TFM) was machined out of sintered soft magnetic composite material (SMC). Due to brittleness of the SMC material potting of stator was necessary.

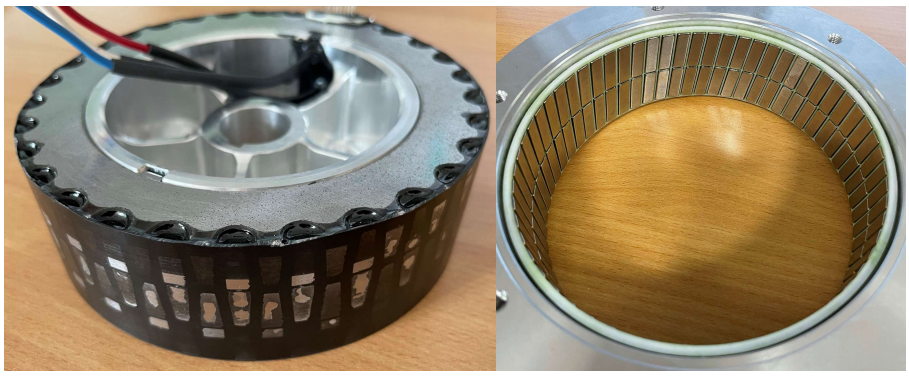

Fig. 8 Transversal Flux Motor

RADIAL MOTOR

Radial motors are wound with aluminum wire that offers lower mass than conventional copper wire.

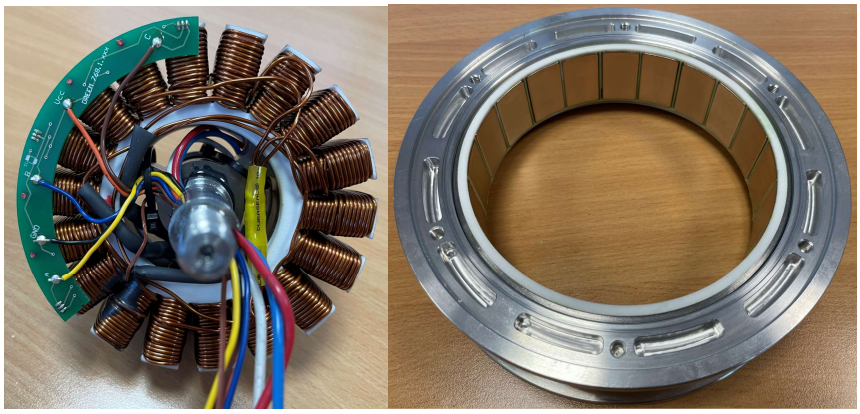

Fig. 9 Radial Motor

HELMET

- Helmet design has been completed for both M, L and XL sizes.

  S = 54-56 centimeters

  M = 56-58 cm

  L = 58-60 cm

  XL = 60-63 cm

- All helmets needed for pilots will be available on time for when they will start.
- Helmets certification on time for pilots too.

- Inflation system: together with the helmets it will be delivered to pilot customers electric/manual pumps.

Fig. 10 – Helmets design

Fig. 11 – Helmets CE marking

Fig. 11 – Helmets inflatable system

Documents de référence : Référentiel : **NF EN 1078 + A1 02/2013**
Reference documentation : *Standard NF EN 1078 + A1 02/2013*

Equipement : **Casque pour cycliste**
Equipment : ***Helmet for pedal cyclist***

Référence(s) commerciale : **BUMPAIR AIR 1.0**
Commercial reference(s) :

Taille(s) *Size(s)* **M (56-58 cm)**

Date(s) de réception de l'échantillon : **22/10/2021**
Date(s) of receipt sample

NF EN 1078 + A1 02/2013 *NF EN 1078 + A1 02/2013*	**CONFORME** *CONFORM*

au regard des résultats des tests réalisés *according to the results of tests carried*

Fig. 12 – Helmets Certification

WP2 – KICK SCOOTER 1ST DESIGN SUB-TASKS TIMING

Month	Task/Milestone	Description
M0	Design thinking preliminary activity	Users' engagement activity, interviewing f2f different category of people in order to gather the main pain points related to urban and suburban mobility.
M1	Bill Of Material Definition	Based on the deisgn thinking activity and the list of technical features ideantified to solve users' pain points, a first version of DREEM scooter Bill of Material has been finalised.
M2	Beta proto development	Procurement and build activity for DREEM scooter Beta version.
M3	Beta proto ready	A first prototype has been finalized
M4	Beta Validation	Test bench and on-road validation has been performed to verify architecture, system robustness and safety.
M5	Beta Validation	Test bench and on-road validation has been performed to verify architecture, system robustness and safety.
M6	Gamma proto development	Procurement and build activity for DREEM scooter Gamma version.
M7	Gamma proto ready	A first prototype has been finalized
M8	Gamma Validation	Test bench and on-road validation has been performed to verify architecture, system robustness and safety.
M9	Gamma Validation	Test bench and on-road validation has been performed to verify architecture, system robustness and safety.
M10	DREEM e-kickscooter 1st RELEASE	Release of first production-oriented DREEEM scooter to be used for pilots.

DREEM E-KICKSCOOTERS

PARTNERS

PUNCH Torino

elaphe

DOMEL

THREE CLOCK

TECNOLOGIE TELEMATICHE TRASPORTI TRAFFICO TORINO

ICLEI Local Governments for Sustainability EUROPE

Bumpair

UNIVERSITY OF GOTHENBURG

TRACTEBEL ENGIE

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