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## Reverse Engineering of Parts with Optical Scanning and Additive Manufacturing

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### Abstract

This paper presents reverse engineering of car volume button. The purpose of article is to introduce reverse engineering procedure, what we need to do this kind of procedure and how we can remanufacture car's volume button. The purpose of reverse engineering is to manufacture another object based on a physic and existing object for which 3D CAD is not available. The first we need digital version of object. Because our car's volume button has free formed surfaces we decided to use 3D scanning technology to obtain the point cloud of existing object. With the help of point cloud we can developed 3D CAD model which will be used for manufacturing of button pair. We used for manufacturing of pair of buttons machine for selective laser sintering Formiga P 100. In the paper are also described costs of making of one pair of buttons and whole workspace.

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### 1. Introduction

Reverse engineering is a kind of engineering which takes advantage of an already created object. The final purpose is to create another object similar to the existing object. Getting this is essential to get information about the physic object. Reverse engineering can be applied in different fields like software, electronic components, big pieces, small pieces.

In this paper we presents reverse engineering which is focused on objects. This method is the most used. It consists of getting the virtual model 3D-CAD of an existing object with the help of software [1, 2]. The virtual model has to be obtained with a scanner.

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The scanner converts the physical object into point cloud. This kind of reverse engineering can be used to make digital 3D record of the objects, for security copies, shows it in presentations to the competitors about how it works, identify potential patent infringement [3].

In our case, we will take advantage of a plastic object. More specifically a plastic button of which we will manufacture both sides, right side and left side form polyamide PA2200 [3, 4, 5].

This button is used for turning up the volume of a car's radio. It has surfaces which have to be perfectly copied because it is the most important part of the button. Behind this surface there are three cylinders and a square which will be used to fix the button on the car's steering wheel.

## 2. Scanning of button

Clearly our case is a case about reverse engineering applied to objects. We are going to scan a physical object which has a complicated geometry and some surfaces. Our piece is small and therefore we need to use the lens with the size 350 x 280 x 280 mm. The lens permits to get a better mesh with more points [6].

The button has to be provided with encoded points which are situated strategically for ensuring a correct mesh. Fig. 1 shows button from front and back side and there are also encoded points.

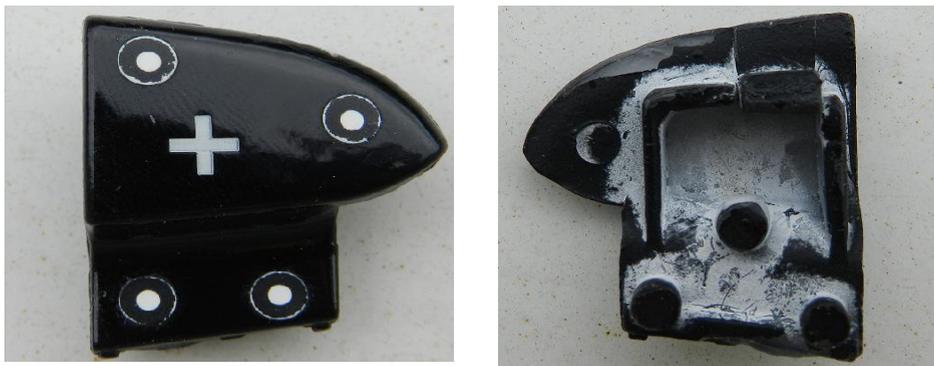


Fig. 1. Button front and back side with encoded points.

For scanning the whole button we have to rotate few times to get every views of the button.

Because the button is black the light is reflected, and we cannot get the right point cloud. This is the reason why we have to paint the piece with a developer spray which paints the button in white, so the button is prepared to be scanned.

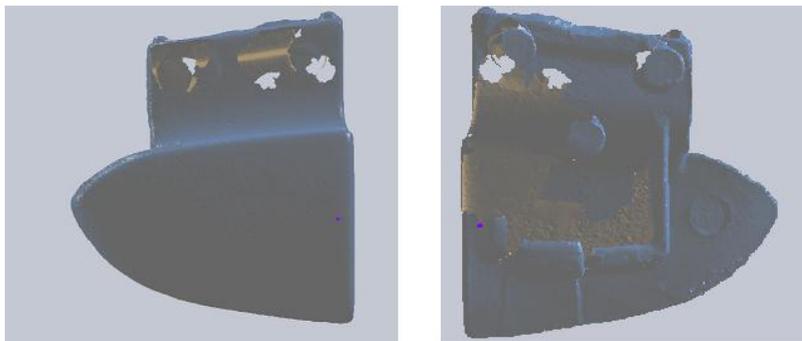


Fig. 2. Mesh after scanning.

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