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# Design and prototype of a control for virtual environment in CHD examination

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## ABSTRACT

The study represents a preliminary step for the complete development of a virtual reality glasses control. This command will have applications for the simulation of the practice of the ultrasound examination in the diagnostic test of Congenital Heart Disease. This will help in the formation of new doctors during their practical class.

In this work 3 analyzes were performed. With the functional analysis, the important parts of the control that will be applied in the prototype were removed. In the morphological analysis the final form of the command was developed, constituting a recognizable form for their respective users, and adding the necessary components for their operation.

Finally, thanks to the ergonomic analysis, the relationship between the machine and the doctor could be understood.

## CCS CONCEPTS

• Insert CCS text here • Insert CCS text here • Insert CCS text here

## KEYWORDS

Congenital Heart Disease, CHD, echocardiography, Control Natural User Interface, NUI.

## ACM Reference format:

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## 1 Introduction

The function and cardiac anatomy are evaluated in detail through the diagnosis of Ultrasound. One of the diseases that can be seen by this procedure are malformations in the fetal heart, also known as Congenital Heart Disease (CHD) [1]. Prenatal diagnosis allows families to prepare for decision making and possible results of the examination by reducing the risks of possible harm due to misdiagnosis. In this way, the increase in costs and complications due to late diagnosis is avoided in institutions dealing with fetal CHD [2] [3]. The International Society of Ultrasound in Obstetrics and Gynecology recommends that outflow and four-chamber views [4] be added to the routine procedure of CHD prenatal screening. The same procedure can also be used for the evaluation of low-risk fetuses, as part of routine prenatal care. For more complex cardiac anomalies, other detection techniques can be used, such as Doppler mode, M-mode, and "cine-loop" [1]. Due to its great complexity, it is recommended that the examination to be performed and interpreted by professionals who have had formal training or experience in fetal echocardiography of CHD [5]. It has been shown that the detection rates of CHD vary according to the type of ultrasound practice and the level or type of training of the examiner [6]. Even so, the rates of prenatal screening vary widely. Some of these variations can be attributed to: maternal obesity, transducer frequency, abdominal scars, fetal position, among others [7]. These variations can make it difficult to obtain the images and all these factors make this test unique.

The recognition of the anatomy of the heart and possible injuries is a gradual process based on the acquisition of new

recognizable form for their respective users, and adding the necessary components for their operation. Finally, thanks to the ergonomic analysis, the relationship between the machine and the doctor could be understood.

The prototype selected corresponds to model C2 (figure 6, front model C and figure 7, lateral model 2). The results of the design and 3D printing show that the shape of the housing is suitable and sufficient for the positioning of the battery and electronic circuit boards.

Making a small comparison, the business models WH003 and G700 allow to develop the skills required for the exam, like the prototype studied here. The main difference is that both models are limited and lack in the representation (virtual and / or real) of the mother's womb. The new prototype will also offer variables such as maternal obesity and gestational age. Finally, it will offer different position conditions of the fetus, not available in the G700 model.

Future studies will be necessary to develop the virtual environment (software and hardware) used for the control prototype presented here for a complete sensorial experience able to simulate, in all its aspects, the diagnostic test for Congenital Heart Disease (CHD)

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