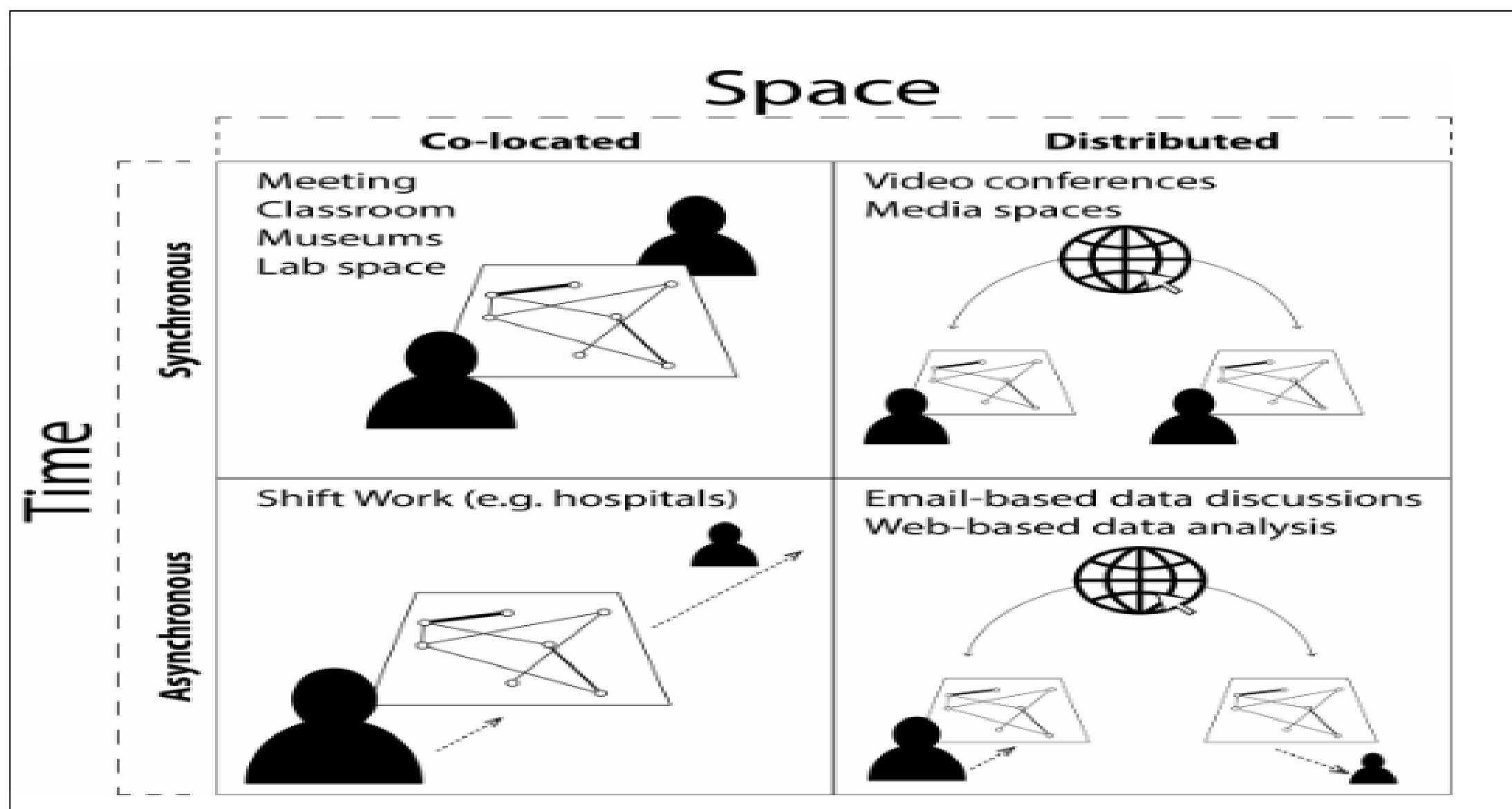


A QUALITY OF EXPERIENCE EVALUATION OF COLLABORATIVE DESIGN TASKS IN VIRTUAL REALITY

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INTRODUCTION

- Collaborative design is a design task performed in a dispersed group of workers with a joint objective. It is a multi-staged process that brings together different ideas, roles and team members.
- Virtual Reality is the use of computer technology to create a simulated environment. Unlike traditional user interfaces, VR places the user inside the experience. Instead of viewing a screen in front of them, users are immersed and able to interact 3D worlds.
- By simulating as many senses as possible, such as vision, hearing and even touch, the presentation system is transformed into a gatekeeper to this artificial world. This gateway is by a wearable hardware known as Head Mounted Display (HMD).
- Virtual Reality promises to enable an almost "physical" co-presence meeting. Nowadays, high levels of interaction & immersion in collaborative virtual environment are possible supporting collaborative design tasks.
- Collaborative virtual environment has several advantages over digital communications. It supports multimodal design actions to make the immersion more, reduces time, costs and provides effective visualization for review of products.
- Together or in separate parts of the world, virtual meetings allow professionals to review their design models and add intricate details necessary.
- Interactive features inside virtual environment enhance the design activities.
- Success of an application is always



RESEARCH QUESTION & OBJECTIVE

The research will investigate the usability and utility of collaborative design task using Virtual Reality and evaluate based on quality of experience principles. part of this evaluation will be to design a collaborative VR application. Then evaluation of the application will take place considering number of factors using implicit, explicit and objective data. We will then use multimodal datasets to develop a machine learning model that can predict user QoE.

METHODOLOGY

This project is divided into four major blocks as shown below.

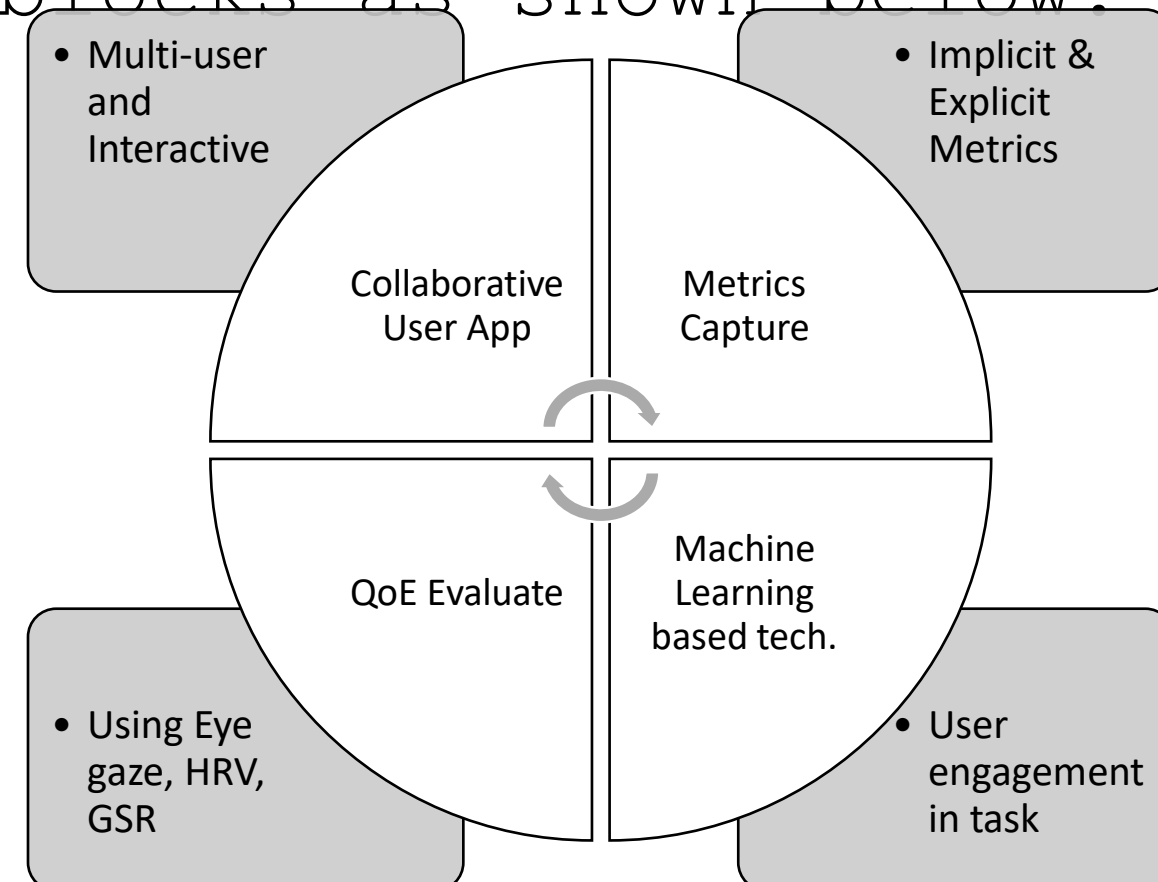


Fig 2: Major blocks of research

There are many frameworks available but selection is based on mainly on the following categories: (a) the Framework should support both desktop and head mounted displays (b) avatar representation of users (c) customization as necessary (d) have high level of naturalistic interaction (e) multimodal communication should be possible. Machine learning techniques can be applied to the metrics captured. Multimodal signals for QoE prediction and evaluation are Eye tracking, Galvanic skin response and HRV.

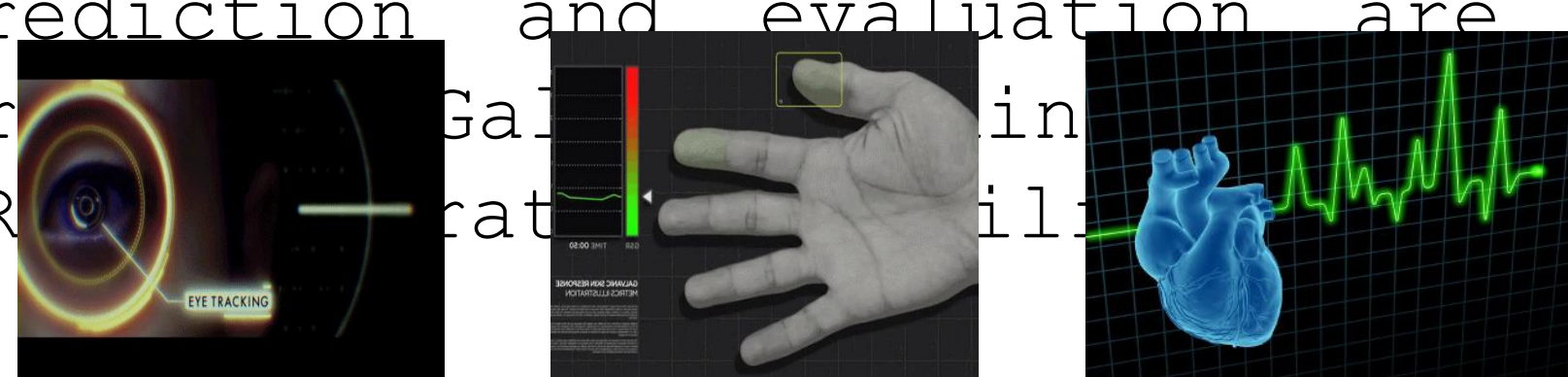
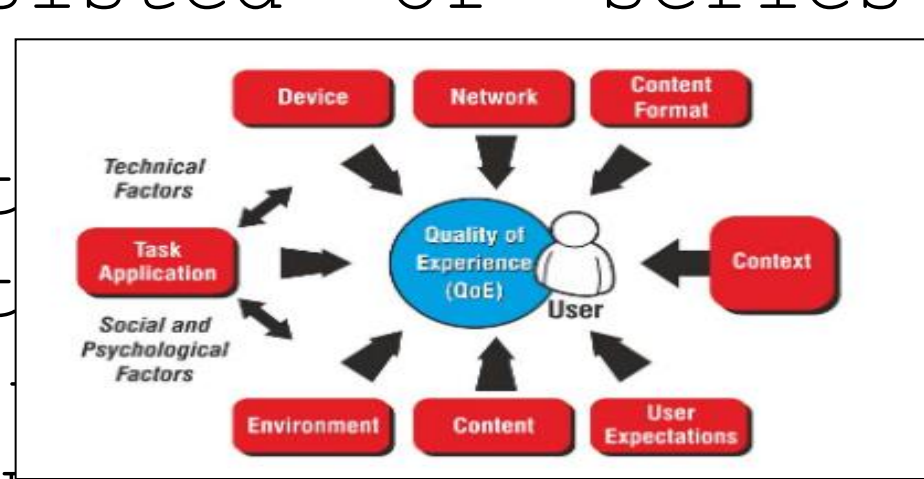


Fig 3: Implicit metrics for QoE Evaluation

QoE evaluation has the following phases :

- Information and Screening Phase: Participants will be provided with information on the test and screened for visual defects
- Resting Phase: Capturing baseline physiological metrics for 5 minutes using multimodal sensors.
- Training Phase: The training phase consisted of series of training participant get the environment will be asked precise using the HMD.
- Testing Phase: Participants will complete a virtual collaborative



COURSE OF ACTION

- System
- The design application should be used in smart factory context. It involves high level of interaction in VR. Fig 4 : QoE impacting factors
- After a comprehensive review and comparing various framework, StageVR is selected satisfying maximum conditions and allowing the developer to customize it.
- Unity Game Engine will be the base platform for development of the application and additional plugins for QoE capture and processing.

PROGRESS ON MULTI-USER FRAMEWORK

- The framework chosen provides the following features which are as follows;
- Infrastructure and data security provided by encrypted presentations. Communication and interaction possible with Avatars and real time voice communication. Screenshots and annotations allow better decision making.
- Moderator leads through the presentation without further knowledge required from the participants.
- The main use cases of the selected framework is collaborative design reviews, layout planning and training.
- Provides option for both Unreal or Unity Plugin for customization
- The STAGE Creator enables to create multi-user capabilities for presentations and projects fast and easy.
- STAGE Creator is designed for an integrated workflow allowing to work the way desired. Work

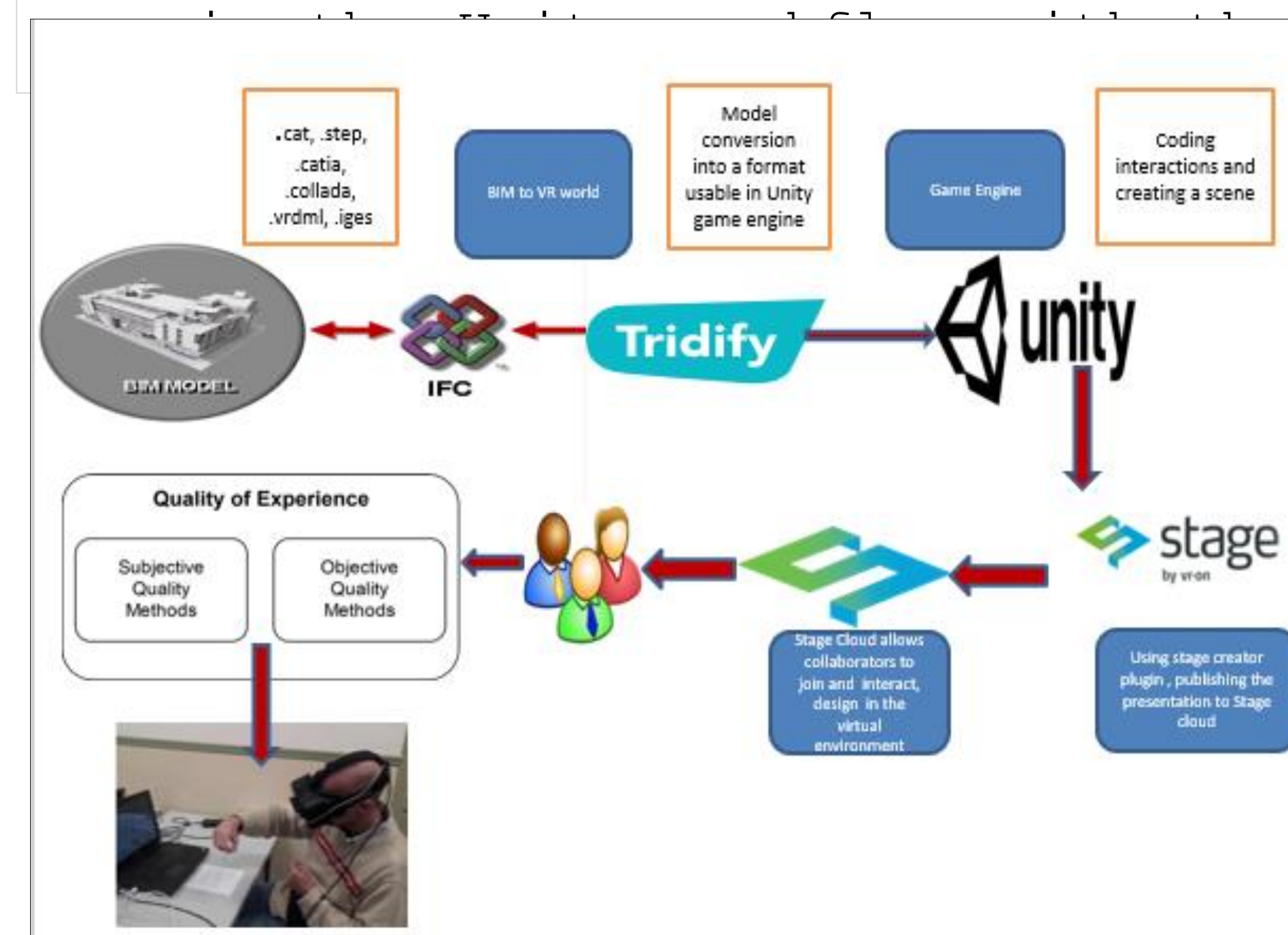


Fig 5 : Flow diagram of the research

FUTURE WORK

- Future work involving more interactions to support the exact requirement for enhancing the use case. And Involving Mixed Reality features inside Virtual Reality environment..
- Trials with users working together remotely synchronously as well as asynchronously
- Tracking more features of the avatars like finger tracking and giving photorealistic approach to the avatars and adding body weight, height to aid more behavioral realism.
- Real-time BIM models for review

ACKNOWLEDGEMENTS

Target is to develop an VR collaborative application fit for CONFIRM Smart Manufacturing in future smart industries use case coordination with SFI and Athlone Institute of Technology interaction and graphical realism.