# PROJECT SYNOPSIS

on

## Motion capture using computer vision

towards partial fulfillment of the requirement

for the award of degree of

## Bachelor of Computer Applications

from

# Babu Banarasi Das University

## Lucknow



## Academic Session 2021 – 2022

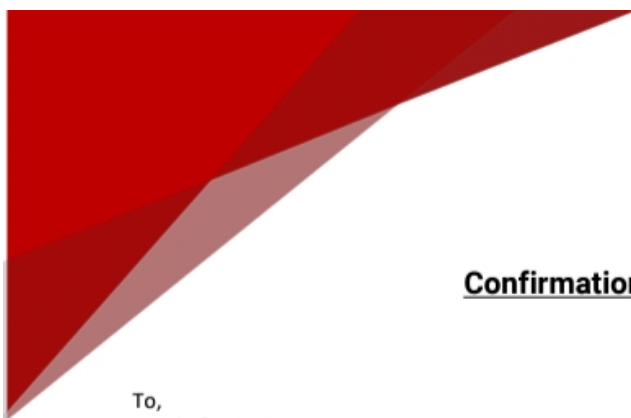School of Computer Applications

**Submitted by:**                                             **Under Guidance of:**

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**University roll no. :** 1190211117

# Certificate

**digipodium**
*signature to success*

**Confirmation Letter**

To,
Head of Department,
BBD University
Lucknow

Sir,
This is to inform you that the following student is pursuing Final Year Project Training from our organization.

Student            : Komal Gautam

Course             : BCA

For any further details kindly contact.

Regards,

Bharvi Sharma
Career Counselor

# **Table of Contents**

| Sr.No. | Contents | Page No. |
|---|---|---|
| 1. | Title of the project | |
| 2. | Objective and Scope of the project | |
| 3. | Resources Used | |
| 4. | Project Schedule Plan | |
| 5. | Project Teams | |
| 6. | Process Description | |
| 7. | Contribution of the Student in project | |
| 8. | Conclusion | |

# Motion Capture using the Computer Vision

***Motion capture (Mo-cap)*** refers to a group of technologies that records the movements of people and objects, and transfers the corresponding data to another application. It's been used for many purposes, from sports therapy, farming, and healthcare, to film and gaming. By mapping real-world movement on computer generated frames, motion capture allows for photorealistic dynamics in a virtual environment.

*The first major step in the development of motion capture was brought by American animator, Lee Harrison III, in the 1960s.* Using a series of analogue circuits, cathode ray tubes, and adjustable resistors, Harrison devised a system that could record and animate a person's movement in real-time.

*"Motion capture is the process of capturing movements from real life into a computer"*. Existing motion capture systems are often very expensive and require advanced hardware that makes the process complex. This thesis will answer the following question: *is it possible to create an optical motion capture system using only a single low cost DVcamera  (Digital Video Camera), that will still produce accurate motion capture data?* To answer this question and construct our motion capture system we need to complete these following steps:
- Create a usable film sequence.
- Analyze the sequence.
- Create motion capture data
- Create motion capture data.

We have found that an optical motion capture system is very complex and it is hard to produce as a low budget system. Our attempt did not live up to our expectations. The idea with using only one DV camera was to simplify the system since it would require no calibration or syncronisation. It would also make the system cost efficient and more available to the general public. The single camera solution unfortunatly created a number of problems in our system. Our system does however work with less complex movements. It can produce motion capture data that is accurate enough to be used in low budget games. It is also cost effective compared to other systems on the market. The system has a very easy setup and does not need any calibration in addition to the init position

In this project we will use the ***computer vision*** for capturing the movements of humans and objects

***"Computer vision"*** is the field of computer science that focuses on creating digital systems that can process, analyse, and make sense of visual data (images or videos) in the same way that humans do. The concept of computer vision is based on teaching computers to process an image at a pixel level and understand it.

After capturing the movements of humans and objects we will then transfer the data to other applications such as **_unity_**

**_"Unity"_** _is a cross-platform game engine initially released by Unity Technologies, in 2005_. The focus of Unity lies in the development of both 2D and 3D games and interactive content. Unity now supports over 20 different target platforms for deploying, while its most popular platforms are the PC, Android and iOS systems

# 2. Objective and Scope :

The main objective of this project is to help the creators by providing the facility of capturing the movements and objects without managing a big studio. This will ultimately reduce the cost of our system.

We will be using the computer vision concept for capturing the data from the human beings by their movements and after that we will be applying pose estimation and pose logic. That pose data will provide us the bone architecture, points or we can say the 3-D track. After that this 3-D track data will be converted and then passed to unity

# 3. Resources (Hardware & Software)

1. **Hardware Requirements :**

**_Client Side_**

| Processor | Dual Core or above |
|-----------|--------------------|
| RAM | 1 GB |
| Disk space | 500 GB |
| Monitor | 15" |
| Others | Keyboard, mouse, Internet Connection |

**_Server Side_**

| Processor | Dual Core or above |
|-----------|--------------------|
| RAM | 1 GB |
| Disk space | 500 GB |
| Monitor | 15" |
| Others | Keyboard, mouse, Internet Connection |

2. **Software Requirements**

**_Client Side_**

- Web Browser (Google Chrome, Firefox, IE9 or above)

**_Server Side_**

- Web Browser (Google Chrome, Firefox, IE9 or above)
- Windows 7 or above / Linux
- VScode
- SQliteManager
- Python 3.7

# 4. Project Schedule Plan:

The objective of Software Planning is to provide a framework that enables the manager to make reasonable estimates of resources, cost, and schedule. These estimates are made within a limited time frame at the beginning of a software project and should be updated regularly as the project progresses. In addition, estimates should attempt to define best case and worst case scenario so that project outcomes can be bounded.

A Gantt chart is a popular type of chart that illustrates a project schedule. Gantt Chart illustrates the start and finish dates of the terminal elements and summary elements of a project. Terminal element and summary comprise the work breakdown structure of the project

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| Task | 27Jan-25Feb | 26Feb-2Mar | 3Mar-2Apr | 3Apr-7May | 8May-13May | 14May-19May |
|---|---|---|---|---|---|---|
| Develop project proposal | 27 days | | | | | |
| Analysis | | 10 days | | | | |
| Designing | | | 30 days | | | |
| Coding | | | | 34days | | |
| Unit Testing | | | | | 5 days | |
| Implementation | | | | | | 5 days |

Figure : gantt chart

# 5. Project Team:

**Instructor**              :        *Zaid Kamil*

**Mentor**                  :        *Sarfaraj Alam*

**Project Team Members**    :        *Ravi Sharma , Naushad Ahmad and Komal Gautam.*

# 6. Process Description

1. **Video camera handle :** Video camera handle purpose is to check whether the webcam is present or not. It select the source of camera if multiple camera are present. It check whether video is recording or not. It read the data from the video.

2. **Image frame extraction :** In image frame extraction we extract the images from video and compress it and then store data in  numerical matrix format .

3. **Image conversion system :** If one specific point can be observed by any two cameras, the point's position can be located in a 3-D space based on triangulation principle. By continuing to capture the frames with high speed camaras, the points are tracked with post-data-processing procedures *(eg. 2-D to 3-D visual human motion conversion)*

4. **Pose estimation AI loader :** this  will load the particular pose model and then this model will be applied to the image and it will make the user bone frame

5. **Bone rendering system :**  This module helps in drawing the bone outline from each pose points.

6. **Pose detection and Frame creation :** this module will display the   user bone frame and detect the pose .

7. **Tracking and capture :** in this we track the movement of the points from their location and capture   in the form of x axis ,y axis and z axis .

8. **Database Handler :** This model manages the database of user's previous work using SQLite/SQLAlchemy database software. We use  SQLALchemy for writing the database coding and for  performing the operation like  CRUD(create, read, update, delete).

9. **Dashboard system :** This module manages the code which provides the user interface better view to user. We allow the camera to be start or not and start the recording and give the title to the video and it also show the previous recording It's is basically the front end for displaying the user interface.

10. **Motion capture file creator :** this module will help in creating a file which fetch the data from database.

11. **Unity integration :** In this module we upload the data in unity and apply the 3 D Model on the data .

12. **3D model uploader :** In this we download the 3D model available on the internet and upload and make it  available  to unity so that it can show the data in form of 3 D model.

13. **Human body extraction and segmentation :** This module helps in identifying the human body from the image and removes the background of the image.

14. **Mocap manager :** Mocap manager is used for managing the files and and folders and also allow us for the creation and deletion of logics

15. **View display Manager :** All the codes related to the fontend and input output of the project are managed by this module.

# 7. Contribution of the student in the project:

- **Ravi Sharma :** Video camera handle, Image frame extraction, Image conversion system, Pose estimation AI loader, Bone rendering system.

- **Naushad Ahmad :** Pose detection and Frame creation, Tracking and capture,  Database Handler, Dashboard system, Motion capture file creator.

- **Komal Gautam :** Unity integration, 3D model uploader, Human body extraction and segmentation, Mocap manager, View display Manager.

# 7. Conclusion:

This human motion capture system will very well complete its indicators, achieved better trial results, meet the basic requirements of motion assessment, that can be further popularized in the relevant fields of biomechanics. At the same time the system confirmed the feasibility of constructing a three-dimensional human body model by the binocular based on extraction of color-coded identification point, which will promote the development of computer vision technology.

# 8. References:

1. https://www.mo-sys.com/what-is-motion-capture-and-how-does-it-work/
2. https://www.frontiersin.org/articles/10.3389/fbioe.2020.00181/full
3. https://arxiv.org/ftp/arxiv/papers/1608/1608.06761.pdf