

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

Video Summarization - Visual Storyboard using video clips

**PROJECT REPORT**

**Submitted by,**

|  |  |
| --- | --- |
| **Shivansh Gupta** | **1RV20CS160** |
| **Aisiri M R** | **1RV20CS012** |
| **Mohammad Bilaal** | **1RV17CS086** |

**Under the guidance of**

Dr. Hemavathy R

Associate Professor

Dept. of CSE

RV College of Engineering

**In partial fulfillment for the award of degree**

**of**

**Bachelor of Engineering**

**in**

**Computer Science and Engineering**

**2023-2024**

**RV COLLEGE OF ENGINEERING®, BENGALURU-59**

**(Autonomous Institution Affiliated to VTU, Belagavi)**

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**



**CERTIFICATE**

Certified that the major project work titled ***‘Video summarization - Visual Storyboard using video clips.’*** is carried out by **Shivansh Gupta (1RV20CS160), Aisiri M R (1RV20CS012), and Mohammad Bilaal (1RV17CS086)** who are bonafide students of RV College of Engineering, Bengaluru, in partial fulfillment for the award of degree of **Bachelor of Engineering** **in Computer Science and Engineering** of the **Visvesvaraya Technological University**, Belagavi during the academic year 2023-2024. It is certified that all corrections/suggestions indicated for the Internal Assessment have been incorporated in the major project report deposited in the departmental library. The major project report has been approved as it satisfies the academic requirements in respect of major project work prescribed by the institution for the said degree.

**Signature of Guide Signature of Head of the Department Signature of Principal**

**Dr. Hemavathy R Dr. Ramakanth Kumar P Dr. K N Subramanya**

**External Viva**

**Name of Examiners Signature with Date**

**1**

**2**

**RV COLLEGE OF ENGINEERING®, BENGALURU-59**

**(Autonomous Institution Affiliated to VTU, Belagavi)**

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**DECLARATION**

We**, Shivansh Gupta (1RV20CS160), Aisiri M R (1RV20CS012), and Mohammad Bilaal (1RV17CS086),** students of eighth semester B.E., department of CSE, RV College of Engineering, Bengaluru, hereby declare that the major project titled ***‘Video summarization - Visual Storyboard using video clips.’*** has been carried out by us and submitted in partial fulfillment for the award of degree of **Bachelor of Engineering** in **Computer Science and Engineering** during the academic year 2023-24.

Further we declare that the content of the dissertation has not been submitted previously by anybody for the award of any degree or diploma to any other university.

We also declare that any Intellectual Property Rights generated out of this project carried out at RVCE will be the property of RV College of Engineering, Bengaluru and we will be one of the authors of the same.

[

Place: Bengaluru

Date:

**Name Signature**

**1.** Shivansh Gupta (1RV20CS160)

**2.** Aisiri M R (1RV20CS012)

**3.** Mohammad Bilaal (1RV17CS086)

**acknowledgement**

We are indebted to our guide**, Dr. Hemavathy R,** Associate Professor**, Dept of CSE** for her wholehearted support, suggestions and invaluable advice throughout our project work and also helped in the preparation of this thesis.

We also express our gratitude to our panel members **Dr. Rajashree Shettar,** Professor and Dean (PG Circuit Branches) and **Dr. Shanta Rangaswamy,** Professor,Department of Computer Science and Engineeringfor their valuable comments and suggestions.

Our sincere thanks to **Dr. Ramakanth Kumar P.**, Professor and Head, Department of Computer Science and Engineering, RVCE for his support and encouragement.

We express sincere gratitude to our beloved Principal, **Dr. K N Subramanya** for his appreciation towards this project work.

We thank all the **teaching staff and technical staff** of the Computer Science and Engineering department, RVCE for their help.

Lastly, we take this opportunity to thank our **family** members and **friends** who provided all the backup support throughout the project work.

**abstract**

This project, titled "Video Summarization - Visual Storyboard using Video Clips," addresses the challenges of information overload and time constraints faced by users when consuming video content. Existing systems struggle to maintain accuracy and relevance in summarizing complex videos, often lacking real-time processing capabilities. Our objective is to develop a robust system for generating concise video summaries and visual storyboards, leveraging advanced AI techniques such as deep learning and multimodal analysis.

The methodology encompasses four phases: Research, Planning and Design, Code Development and Execution, and Results and Analysis. We utilized Python for implementing deep learning algorithms, Google Colab for training models, and custom datasets from YouTube for testing. The system's architecture integrates CNNs and RNNs for feature extraction and sequence modeling, alongside attention mechanisms for improved summarization quality. The process includes preprocessing video data, extracting key frames, and generating visual storyboards with contextual relevance.

Experimental results demonstrate that our system effectively summarizes videos with high accuracy and user satisfaction. The robustness of the system is highlighted by its ability to handle large datasets and multiple concurrent users without performance degradation. Specifically, the system processes videos with lengths ranging from 2 minutes to 1 hour, maintaining an average processing time of 3 seconds per minute of video. The system supports up to 500 simultaneous users, ensuring stable and reliable performance. Statistical analyses confirmed the significant differences in processing times between the prompts, validating our approach. The performance metrics, including processing time, standard deviation, and user satisfaction, highlight the system's robustness and reliability.

In conclusion, our project successfully addresses the identified gaps in video summarization and storyboard generation. Future work will focus on optimizing processing times, enhancing story quality, and integrating real-time summarization capabilities. User feedback will be incorporated to refine algorithms, ensuring continuous improvement and adaptability to diverse video content types.

**acronyms**

1. **GAI:** Generative Artificial Intelligence
2. **LLM:** Large Language Model
3. **CNN:** Convolutional Neural Network
4. **NLP:** Natural Language Processing
5. **API:** Application Programming Interface
6. **RNN:** Recurrent Neural Network
7. **VS Code:** Visual Studio Code

**table of contents**

**Page No.**

**Abstract**

**List of Tables**

**List of Figures**

|  |  |
| --- | --- |
| **Chapter 1**  **Introduction** | **12** |
| 1.1. State of Art Developments | 12 |
| 1.2. Motivation | 12 |
| 1.3. Problem Statement | 12 |
| 1.4. Objective | 13 |
| 1.5. Scope | 13 |
| 1.6. Methodology | 13 |
| 1.7. Organization of the Report | 14 |
| 1.8. Summary | 14 |

|  |  |
| --- | --- |
| **Chapter 2**  **Overview of Video summarization - Visual Storyboard using video clips** | **15** |
| 2.1. Introduction | 15 |
| 2.2. Relevant information | 15 |
| 2.3 Summary | 16 |

|  |  |
| --- | --- |
| **Chapter 3**  **Software Requirements Specification of Video summarization - Visual Storyboard using video clips** | **17** |
| 3.1. Overall Description | 17 |
| 3.2. Specific Requirements | 17 |
| 3.2.1 Functional Requirements | 17 |
| 3.2.2. Performance Requirements | 18 |
| 3.2.3. Software Requirements | 18 |
| 3.2.4. Hardware Requirements | 18 |
| 3.2.5. Non-Functional Requirements | 18 |
| 3.3. Summary | 20 |

**Chapter 4**

**High Level Design of Video summarization -**

**Visual Storyboard using video clips 21**

4.1. Design Considerations 21

|  |  |
| --- | --- |
| 4.2. System Architecture | 21 |
| 4.3. Data Flow Diagram | 22 |
| 4.3.1. Data Flow Diagram – Level 0 | 22 |
| 4.3.2. Data Flow Diagram – Level 1 | 22 |
| 4.4. Summary | 23 |

|  |  |
| --- | --- |
| **Chapter 5**  **Detailed Design of Video summarization - Visual Storyboard using video clips** | **24** |
| 5.1. Structure Chart | 24 |
| 5.2. Functional Description of the Modules | 25 |
| 5.3. Summary | 26 |

|  |  |  |
| --- | --- | --- |
| **Chapter 6**  **Implementation of Video summarization - Visual Storyboard using video clips** | **27** | |
| 6.1. Programming Language Selection | 27 | |
| 6.2. Platform Selection | 27 | |
| 6.3. Code Conventions | 27 | |
| 6.4. Summary | | 28 |

|  |  |
| --- | --- |
| **Chapter 7**  **Software Testing of Video summarization - Visual Storyboard using video clips** | **29** |
| 7.1. Test Environment | 29 |
| 7.2. Unit Testing | 29 |
| 7.3. Integration Testing | 29 |
| 7.4. System Testing | 30 |
| 7.5. Summary | 30 |
| **Chapter 8** |  |
| **Experimental Results and Analysis of Video summarization - Visual Storyboard using video clips** | **31** |
| 8.1. Evaluation Metrics | 31 |
| 8.2. Experimental Dataset | 31 |
| 8.3. Performance Trend Analysis | 33 |
| 8.4. Performance Analysis | 34 |
| 8.5. Image to Storyboard Prompt Analysis | 41 |
| 8.6. Summary | 50 |

|  |  |
| --- | --- |
| **Chapter 9** |  |
| **Conclusion and Future Enhancement** | **51** |
| 9.1. Limitations of the Project | 51 |
| 9.2. Future Enhancements | 51 |
| 9.3. Summary | 52 |
| **References** | **53** |
| **Appendices** | **55** |
| **Appendix 1: Screenshots** | **55** |
| **Appendix 2: Publication details** | **60** |
|  |  |

**List of Tables**

|  |  |  |
| --- | --- | --- |
| **TABLE NO.** | **NAME** | **PAGE NO.** |
| 1 | Kids Story | 31 |
| 2 | Education | 32 |
| 3 | Vlog | 32 |
| 4 | Science Experiments | 33 |
| 5 | Average Processing Time | 34 |
| 6 | Standard Deviation of Processing Time | 35 |
| 7 | Correlation Coefficient | 36 |
| 8 | Statistical Analysis | 37 |
| 9 | Effect Size and Throughput | 38 |
| 10 | User Satisfaction | 40 |

**List of Figures**

|  |  |  |
| --- | --- | --- |
| **FIG NO.** | **TITLE** | **PAGE NO.** |
| 1 | Methodology | 13 |
| 2 | Structure Chart | 21 |
| 3 | DFD Level 0 | 22 |
| 4 | DFD Level 1 | 23 |
| 5 | Video Summarization Flowchart | 24 |
| 6 | Storyboard Creation Flowchart | 25 |
| 7 | Performance Analysis | 33 |
| 8 | Average Processing Time Bar Chart | 35 |
| 9 | Standard Deviation of Processing Time Bar Chart | 36 |
| 10 | Correlation Coefficient Chart | 37 |
| 11 | Effect Size Bar Chart | 38 |
| 12 | Throughput Bar Chart | 39 |
| 13 | User Satisfaction Bar Chart | 40 |
| 14 | Timid Mouse and Brave Lion: Analysis Score | 42 |
| 15 | Public Key Cryptography: Analysis Score | 43 |
| 16 | Exploring Tskaltubo: Analysis Score | 44 |
| 17 | Young Kitchen Detective: Analysis Score | 45 |
| 18 | Gingerbread Man Adventure: Analysis Score | 47 |
| 19 | Ethan and CipherLock: Analysis Score | 48 |
| 20 | Abandoned Soviet Spa Town: Analysis Score | 49 |
| 21 | Introducing Acids, Bases and Salts: Analysis Score | 50 |