MINOR PROJECT REPORT

ON

**IMPLEMETATION OF**

**CLOUD BURST PREDICTION SYSTEM**

Submitted in partial fulfillment of the requirements

For the award of the degree of

**BACHELOR OF TECHNOLOGY**

**IN**

**ELECTRONICS AND COMMUNICATION ENGINEERING**

Submitted By

**Kshitij Chaturvedi Kanishk Patel Jatin Sardana**

**00315602821 02515602821 02115602821**

**Under the guidance of**

Dr. SURENDER DHIMAN, HOD, ECE Department

**

**Department of Electronics & Communication Engineering Dr. Akhilesh Das Gupta Institute of Professional Studies**

**Guru Gobind Singh Indraprastha University**

**Dwarka, Delhi-110078.**

**November- 2024**

**CERTIFICATE**

I/We hereby certify that the work that is being presented in the project report entitled **Implementation of Cloud Burst Prediction System using Advanced Deep Learning** to the partial fulfilment of the requirements for the award of the degree of Bachelor of Technology in Electronics & Communication Engineering from Dr **Akhilesh Das Gupta Institute of Professional Studies**, New Delhi. This is an authentic record of our own work carried out during a period from Aug, 2024 to Nov, 2024 under the guidance of **Dr. Surender Dhiman, H.O.D of ECE department.**

The matter presented in this project has not been submitted by us for the award of any other degree elsewhere.

**Kshitij Chaturvedi Kanishk Patel Jatin Sardana**

**00315602821 02515602821 02115602821**

F4F4 F4

This is to certify that the above statement made by the candidates is correct to the best of our knowledge.

**(Dr.) SURENDER DHIMAN**

**H.O.D., ECE Department.**

**Mr. Devraj Gautam Prof. (Dr.) Surender Dhiman**

**Project In-charge H.O.D., ECE Department.**

**ECE Department.**

**ACKNOWLEDGEMENT**

We would like to acknowledge the contributions of the following persons, without whose help and guidance this report would not have been completed.

We acknowledge the counsel and support of our project guide **Mr. Devraj Gautam, Assistant Professor, ECE department,** with respect and gratitude, whose expertise, guidance, support, encouragement, and enthusiasm has made this report possible. Their feedback vastly improved the quality of this report and provided an enthralling experience. We are indeed proud and fortunate to be supervised by him.

We are thankful to **Prof.** (**Dr.) Surender Dhiman**, **H.O.D. ECE department, Dr. Akhilesh Das Gupta Institute of Professional Studies, New Delhi** for his constant encouragement, valuable suggestions and moral support and blessings.

We are immensely thankful to our esteemed, **Prof. (Dr.) Niranjan Bhattacharya, Director, Dr. Akhilesh Das Gupta Institute of Professional Studies, New Delhi** for his never-ending motivation and support.

We shall always remain indebted to Mr. Devraj Gautam, the project in charge of the ECE department,and faculty and staff members of **Dr Akhilesh Das Gupta Institute of Professional Studies, New Delhi.**

Finally, yet importantly, we would like to express our heartfelt thanks to God, our beloved parents for their blessings, our friends/classmates for their help and wishes for the successful completion of this project.

**Kshitij Chaturvedi Kanishk Patel Jatin Sardana**

**00315602821 02515602821 02115602821**

**Dr. Akhilesh Das Gupta Institute of Professional Studies**

**Electronics and Communication Engineering**

|  |  |
| --- | --- |
| **Vision Of Department:** To produce World class Electronics & Communication Engineers through academic excellence and innovations, who would be competent Technocrats with work ethics to meet the needs of the society | |
| **Mission of Department** | **Program Educational Objectives (PEOs)** |
| **M1.** To impart quality education for excelling in the field of Electronics & Communication Engineering to face real world challenges in existing and emerging domains. | ***PEO1:*** Graduates shall excel in the field of electronics and communication engineering by applying their acquired knowledge and skills to develop feasible and viable solutions to engineering challenges of the country. |
| **M2.** To provide a creative platform for promotion of innovations in the field of Electronics & Communication Engineering by keeping close proximity to industry. | ***PEO2:*** Graduates shall be adaptive to innovations and new technologies which shall lead them to professional excellence. |
| **M3.** To provide conducive environment for development of work ethics and prepare socially responsible citizens. | ***PEO3:*** Graduates shall manage resources skillfully and practice the profession with ethics, integrity and social responsibility. |

**ABSTRACT**

The Cloud Burst Prediction system utilizes real-time meteorological data combined with advanced machine learning techniques to accurately forecast sudden, intense rainfall events that could lead to flash floods and severe damage. The system continuously collects and monitors real-time atmospheric parameters, including humidity, temperature, pressure, and rain intensity, through hardware sensors linked to a database. This data is then analyzed by a predictive model trained on extensive historical weather data, enabling it to detect conditions conducive to cloud bursts with high precision.

Incorporating real-time data acquisition and predictive analytics, this system delivers proactive alerts and early warnings, allowing authorities and communities in vulnerable areas to take timely preventive actions. Its primary objectives include improving disaster readiness, minimizing risk to life and infrastructure, and enhancing resilience against extreme weather events in regions prone to sudden, intense rainfall. By bridging data science and meteorology, this project aims to provide a scalable, efficient solution for cloud burst prediction, aiding in the mitigation of weather-related disasters.

**TABLE OF CONTENTS**

* Title Page
* Certificate i.
* Acknowledgement ii.
* Vision Mission iii.
* Abstract iv.
* Table of Contents v.
* List of Figure vi.
* List of Tables vii.

**CHAPTER 1: INTRODUCTION AND LITERATURE REVIEW**

* 1. Introduction 1
  2. Basic terms of project 1
  3. Literature Overview 2
  4. Project Motivation 4
  5. Organization of Project Report 5

**CHAPTER 2: METHODOLOGY ADOPTED**

2.1. Objectives 6

2.2. Tool used 7

2.3. Work Flow diagram of proposed work 9

**CHAPTER 3: DESIGNING AND RESULT ANALYSIS**

3.1. Block diagram of proposed work 11

3.2. Designing steps 13

3.3. Simulated results analysis 30

**CHAPTER 4: MERITS, DEMERITS AND APPLICATIONS**

4.1. Merits 34

4.2. Demerits 35

4.3. Applications 36

**CHAPTER 5: CONCLUSIONS AND FUTURE SCOPE**

5.1. Conclusion 37

5.2. Future Scope 37

**REFERENCES 39**

**APPENDIX 42**

**LIST OF FIGURES**

|  |  |  |
| --- | --- | --- |
| **Figure No.** | **Title of Figure** | **Page No.** |
| Fig 2.1. | ESP32 NodeMCU Module | 8 |
| Fig 2.2. | Workflow Architecture | 9 |
| Fig 3.1. | Rain Sensor with Buzzer | 11 |
| Fig 3.2. | DHT11 Sensor with OLED Display | 11 |
| Fig 3.3. | Breadboard Circuit with Integrated Sensor Modules | 12 |
| Fig 3.4. | LSTM Architecture | 12 |
| Fig 3.5. | Time Series Graph Plot | 16 |
| Fig 3.6. | Time Series Plot for May 2021 | 17 |
| Fig 3.7. | Correlation Heatmap | 18 |
| Fig 3.8. | Distribution Plot (Histogram) | 19 |
| Fig 3.9. | Box Plot | 19 |
| Fig 3.10. | Yearly Data Trend Graph | 20 |
| Fig 3.11. | Simple ANN Architecture | 25 |
| Fig 3.12. | Generic RNN Architecture – Unfolded Overtime | 26 |
| Fig 3.13. | LSTM Memory Cell | 27 |
| Fig 3.14. | Model Deployment using Fast-API & Docker | 29 |
| Fig 3.15. | Training & Validation Loss Plot | 31 |
| Fig 3.16. | Actual Vs. Predicted Graph | 32 |
| Fig 3.17. | LSTM v/s GRU | 33 |
| Fig 5.1. | Himachal Pradesh cloudburst Tragedy | 38 |
| Fig A.1. | Hourly Historical Data from Open-Mateo API | 42 |
| Fig A.2. | User Interface | 43 |

**LIST OF TABLES**

|  |  |  |
| --- | --- | --- |
| **Table No.** | **Title of Table** | **Page No.** |
| Table 3. 1. | Model Architecture Table | 28 |
| Table 3. 2. | Training and Validation Metrics Table | 31 |