PROJECT REPORT - INTER DISCIPLINARY

AI-INTEGRATED HOME AND COMMUNITY PROTECTION SYSTEM

SUPPORT SDG 11

(PROJECT PHASE- II)

*submitted in partial fulfillment of the requirements*

*for the award of the degree in*

**BACHELOR OF TECHNOLOGY**

By

**THANUSH K (211191101159)**

**SANTHOSH R (211191101131)**

**PIOUS NIRANJAN.A (211051101615)**

**DHANUSH RAJ.N (211051101005)**

**DEPARTMENT OF**

**COMPUTER SCIENCE ENGINEERING & CIVIL ENGINEERING**



**APRIL 2025**



**DEPARTMENT OF COMPUTER SCIENCE ENGINEERING & CIVIL ENGINEERING**

**BONAFIDE CERTIFICATE**

This is to certify that this Project Report (Project Phase-II) is the bonafide work of

Mr. THANUSH K Reg. No: 211191101159,

Mr. SANTHOSH R Reg. No: 211191101131,

Mr. PIOUS NIRANJAN A Reg. No: 211051101615,

Mr. DHANUSH RAJ N Reg. No: 211051101005,

Who Carried out the project entitled **“AI-Integrated Home and Community Protection System Support SDG 11”** under our supervision from Dec 2024 to Apr 2025.

|  |  |  |
| --- | --- | --- |
| **Internal Guide** | **Project Coordinator** | **Department Head** |
|  |  |  |
| **Mrs.A.MAHESWARI** | **Mr. M. ARUN** | **Dr. S. GEETHA** |

**Asst.Professor & Deputy HOD          Assistant Professor        Professor & HOD**

**Dept of CSE(DS&AI)                Dept of CSE                 Dept of CSE**

              Dr. MGR Educational and Research                Dr. MGR Educational and Research     Dr. MGR Educational and Research

      Institute, Deemed to be University                    Institute, Deemed to be University          Institute, Deemed to be University

|  |  |  |
| --- | --- | --- |
| **Dr.V. PRIYADARSHINI** | **Dr.T.KAVITHA   Dr.T.KAVITHA** |  |

**Associate Professor         Professor & HOD   Professor & HOD**

**Dept of CIVIL                   Dept of CIVIL             Dept of CIVIL**

              Dr. MGR Educational and Research              Dr. MGR Educational and Research Dr. MGR Educational and Research

Institute, Deemed to be University    Institute, Deemed to be University Institute, Deemed to be University

**Submitted for Viva Voce Examination held on \_\_\_\_\_\_\_\_\_\_\_**

**Internal Examiner External Examiner**

# DECLARATION

We **THANUSH K (211191101159), SANTHOSH R (211191101131), PIOUS NIRANJAN A (211051101615), DHANUSH RAJ N (211051101005)** hereby declare that the Project Report (Project Phase-II) entitled **“****AI-Integrated Home and Community Protection System Support SDG 11”** is done by us under the guidance of **Dr.V.PRIYADARSHINI, Associate Professor & Mrs.A.MAHESWARI, Asst.Professor & Deputy HOD** is submitted in partial fulfillment of the requirements for the award of the degree in BACHELOR OF TECHNOLOGY in Computer Science Engineering & Civil Engineering.

# DATE:

# PLACE:

# SIGNATURE OF THE CANDIDATE(S)

# ACKNOWLEDGEMENT

We would first like to thank our beloved Founder Chancellor

**Thiru**.**Dr. A.C.SHANMUGAM, B.A., B.L.,** President **Er. A.C.S.Arunkumar, B.Tech., M.B.A.,** and Secretary **Thiru A.RAVIKUMAR** for all the encouragement and support extended to us during the tenure of this project and also our years of studies in his wonderful University.

We express my heartfelt thanks to our Vice Chancellor

**Prof. Dr. S. GEETHALAKSHMI** in providing all the support of my Project (Project Phase-II).

We express my heartfelt thanks to our Head of the Department, **Prof. Dr. S.Geetha**,**Dr.T. KAVITHA**, **CSE & CIVIL** who has been actively involved and very influential from the start till the completion of our project.

Our sincere thanks to our Project Coordinators **Mr. M Arun, Dr.T. KAVITHA, CSE & CIVIL** and Project guide **Mrs.A.MAHESWARI , Dr.V.PRIYADARSHINI** for their continuous guidance and encouragement throughout this work, which has made the project a success.

We would also like to thank all the teaching and non-teaching staffs of Computer Science and Engineering & CIVIL Engineering department, for their constant support and the encouragement given to us while we went about to achieving my project goals.

**CONTENTS**

|  |  |  |
| --- | --- | --- |
| **CHAPTER NO** | **TITLE** | **PAGE NO** |
|  | **Title Page** | **I** |
| **Bonafide certificate** | **II** |
| **Declaration** | **III** |
| **Acknowledgement** | **IV** |
| **Contents** | **V** |
| **List of Abbreviations** | **VIII** |
| **List of Figures** | **IX** |
| **List of Tables** | **X** |
| **Abstract** | **XI** |
| **MAJOR DESIGN CONSTRAINTS AND DESIGN STANDARDS TABLE** | **XII** |
| **1** | **INTRODUCTION** | **01** |
| * 1. Problem Statement | **01** |
| * 1. Need for IoT and AI-Driven Safety Solutions | **01** |
| * 1. Proposed Solution | **01** |
| * 1. Significance and Impact   2. Detailed Explanations of Emergency Scenarios | **01**  **02** |
| **2** | **LITERATURE SURVEY** | **04** |
| * 1. Literature Survey Insight and Inspiration | **04** |
| * + 1. Overview of Literature Survey | **05** |
| **3** | **PROPOSED SYSTEM** | **17** |
| * 1. System Requirements   2. Hardware Components   3. Software Components   4. Communication Flow   5. Working Principle | **17**  **17**  **18**  **18**  **18** |
| **4** | **DESIGN & IMPLEMENTATION** | **19** |
| * 1. PROTOTYPE DESIGN   2. TESTING SCENARIOS      1. GAS LEAK SIMULATION      2. THEFT BUTTON/ MEDICAL BUTTON      3. FIRE DETECTION USING FLAME SENSOR      4. TESTING ACCURACY SCENARIOS      5. FALSE ALARMS      6. POWER CONSUMPTION | **20**  **21**  **21**  **21**  **20**  **22**  **22**  **23** |
| * 1. DESIGN | **24** |
| 4.3.1 DFD Level 0 (Context Diagram) | **24** |
| 4.3.2 Level 1 DFD | **25** |
| 4.3.3 Level 2 DFD | **27** |
| * 1. UML DIAGRAMS | **27** |
| * + 1. Use Case Diagram | **28** |
| * + 1. Class Diagram | **29** |
| * + 1. Sequence Diagram | **30** |
| * + 1. Activity Diagram | **31** |
| * + 1. Communication Diagram | **34** |
| * + 1. Deployment Diagram   1. Implementation Arduino IDE Code | **35**  **37** |
| **5** | **RESULTS & DISCUSSION** | **44** |
| * 1. Case Study      1. Case Study 1: House 1 and House 2 (Fire Detection)      2. Case Study 2: House 1 and House 2 (Gas Leak Detection)      3. Case Study 3: House 1 and House 2 (Theft Detection)      4. Case Study 4: House 1 and House 2 (Medical Emergency)      5. Case Study 5: False Alarm and Acknowledgment Button | **44**  **44**  **45**  **46**  **47**  **47** |
| **6** | **CHALLENGES & LIMITATIONS**   * 1. Potential False Alarms   2. Wi-Fi & MQTT Reliability   3. Large-scale deployment in urban communities introduces challenges | **50**  **50**  **50**  **50** |
| **7** | **CONCLUSION & FUTURE WORK**   * 1. System Summary & Community Safety Improvement   2. Future Enhancements | **51**  **51**  **51** |
|  | **References** | **53** |

# LIST OF ABBREVIATIONS

**AI** Artificial Intelligence

**NLP** Natural Language Processing

**IoT** Internet of Things

**SDGs** Sustainable Development Goals

**MQTT** Message Queuing Telemetry Transport

**LIST OF FIGURES**

|  |  |  |
| --- | --- | --- |
| **Figure .No** | **Figure Name** | **Page.No** |
| 4.1 | Circuit Diagram & Hardware Setup | 18 |
| 4.2 | TESTING ACCURACY SCENARIOS | 21 |
| 4.3 | Represents Architecture Diagram | 22 |
| 4.4 | Level 0 DFD | 23 |
| 4.5 | Level 1 DFD | 24 |
| 4.6 | Level 2 DFD | 26 |
| 4.7 | Use Case Diagram | 27 |
| 4.8 | Class Diagram | 28 |
| 4.9 | Sequence Diagram | 29 |
| 4.10 | Activity Diagram | 31 |
| 4.11 | Communication Diagram | 32 |
| 4.12 | Deployment Diagram | 33 |
| 5.1 | Prototype Working Model | 42 |
| 5.2 | Case Study 1: Fire Detection | 43 |
| 5.3 | Case Study 2: Gas Detection | 43 |
| 5.4 | Case Study 3: Theft Detection | 44 |
| 5.5 | Case Study 4: Medical Detection | 45 |
| 5.6 | Case Study 5:( False Alarm) | 46 |

**LIST OF TABLES**

|  |  |  |
| --- | --- | --- |
| **Table.No** | **Table Name** | **Page.No** |
| 4.1 | Response Time for Different Scenarios | 21 |
| 4.2 | False Alarm Rate | 22 |
| 4.3 | Power Consumption Estimates | 22 |

**ABSTRACT**

Safety in the community is still a major issue in smart city planning, with growing issues of theft, fire risks, gas leaks, and delayed emergency responses. A survey of residential communities in Chennai found that 65.2% of the respondents had theft incidents, mostly in community areas (83.5%), and 55.6% had gas leaks, with 72.8% showing high concern for safety threats. To counteract the limitations, we developed an AI-Based Home and Community Safety System based on IoT-based sensors, real-time communication protocols, and mobile-based monitoring interface. The system consists of flame and gas sensors, OLED display, theft, medical, and false alarm push buttons, and buzzers and LED indicators for notification. A wireless communication framework based on MQTT protocol supports real-time emergency notification among the households to provide immediate response and risk reduction. There is also an IoT dashboard on mobile provided for real-time remote monitoring and controlling of the system, which facilitates ease of access and user interaction. The survey also reflected high community interest in AI-based safety systems with 67.4% considering them to be highly effective and 79.7% willing to trial the system. Prototype testing proved low-latency notifications, efficient hazard detection, and enhanced emergency response systems. The suggested system is in compliance with Sustainable Development Goals (SDG 11 & SDG 9) by increasing the resilience of cities and encouraging smart safety infrastructure.

**Keywords**: Community safety, AI, IoT, MQTT, Smart cities, Emergency response, Sustainable Development Goals, Urban resilience, IoT dashboard, Remote monitoring.

MAJOR DESIGN CONSTRAINTS AND DESIGN STANDARDS TABLE

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Student Group | A.Pious Niranjan (211051101615) | N.Dhanush Raj (211051101005) | K.Thanush (211191101159) | R.Santhosh (211191101131) |
| Project Title | AI-Integrated Home and Community Protection System Support SDG 11 | | | |
| Program Concentration  Area | Smart cities and Urban Development, Internet of Things (IoT) and AI Integration, Sustainable Development and Resilience | | | |
| Constraints Example | Technical Constraints, Cost Constraints, Environmental Constraints, User Adoption and Acceptance Constraints, Maintenance and Support Constraints | | | |
| Economic | Yes | | | |
| Environmental | Yes | | | |
| Sustainability | Yes | | | |
| Implementable | Yes | | | |
| Ethical | N/A | | | |
| Health and Safety | Yes | | | |
| Social | Yes | | | |
| Political | No | | | |
| Other | Power Modulation from Solar Panel | | | |
| Standards |  | | | |
| 1 | ISO/IEC 23894:2023 | | | |
| 2 | IEEE 1451 | | | |
| 3 | IEEE 802.11 | | | |
| 4 | IEEE P2413 | | | |
| 5 | NFTA 72 | | | |
| 6 | UL268 | | | |
| Prerequisite Courses for the Major Design  Experiences | 1. IoT and Smart System Integration  2. Artificial Intelligence for Security Applications  3. Wireless Communication and Networking | | | |