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E-Gram Panchayat

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Abstract: *The increasing demand for transparent, efficient, and citizen-centric governance in rural areas has necessitated the digital transformation of traditional administrative systems. This paper presents an e-Gram Panchayat System, a cloud-enabled digital governance platform designed to streamline administrative functions and improve service delivery in rural villages. By integrating cloud computing, mobile access, and web- based technologies, the system offers a centralized portal for managing records, issuing certificates, publishing notices, monitoring development activities, and enhancing communication between citizens and local authorities. The proposed system ensures real-time data access, promotes transparency, minimizes paperwork, and enables remote accessibility. Pilot implementation in a rural village demonstrated enhanced administrative efficiency, quicker service delivery, and higher citizen satisfaction. This study underscores the role of e- governance in empowering rural communities and improving public service management.*

Keywords: E-Governance, Digital Panchayat, Rural Development, Public Service Delivery, Smart Villages, Paperless Governance.

I. INTRODUCTION

Traditional Gram Panchayat administrative methods are paper-intensive, slow, and prone to errors, making them inefficient in managing today's growing population and development needs. The e-Gram Panchayat System for Nimgoan Ketki is a comprehensive digital platform aimed at modernizing local governance through digital means. It enables panchayat officials to maintain records, process documents, and interact with citizens through a user-friendly portal accessible via desktops and mobile devices. The system is built on cloud technology, ensuring scalability, security, and data redundancy. It supports services like issuing birth/death certificates, property tax collection, grievance redressal, project monitoring, and record management. By facilitating digital workflows and reducing human intervention, the system ensures accuracy, accountability, and efficiency in day-to-day village administration.

II. RELATED WORK - LITERATURE SURVEY

Rural governance in India continues to face significant challenges due to outdated administrative practices, including manual record-keeping, paper-based workflows, and limited access to real-time data. In villages like Nimgoan Ketki, these issues manifest as delays in service delivery, frequent loss or damage of important records, lack of transparency in decision-making, poor communication between officials and villagers, and limited monitoring of local development projects.

To address such issues, the Government of India has initiated several programs, most notably the e-Panchayat Mission Mode Project, aimed at digitizing the functioning of Gram Panchayats. Although this initiative marks a step toward modernization, its implementation in villages like Nimgoan Ketki remains limited due to challenges such as lack of technical infrastructure, minimal awareness, and insufficient training among panchayat officials.

Technological innovations such as Cloud Computing and the Internet of Things (IoT) offer promising solutions to bridge these gaps:

• Cloud Computing enables secure, remote storage and access to records, ideal for rural areas with limited connectivity but widespread mobile usage. It also facilitates scalability, data backup, and centralized management.

• IoT Devices, such as biometric attendance systems, digital notice boards, and environmental sensors, can assist in real-time data collection, automate routine tasks, and support better decision-making at the local level.

Various digital platforms have emerged to improve rural governance:

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• eGramSwaraj, developed by the Ministry of Panchayati Raj, offers a unified platform for budgeting, planning, accounting, and monitoring Gram Panchayat activities. However, its interface and features are not always localized or user- friendly enough to meet the specific administrative needs of villages like Nimgoan Ketki.
• The Digital India Programme also contributes by promoting digital literacy, expanding internet connectivity, and enabling online access to government services in rural areas.
Despite these national-level efforts, the reality on the ground shows that many of these systems fall short in delivering real- time data processing, multi-user access, mobile compatibility, and flexibility for customization at the village level.
Need for an Improved System for Nimgoan Ketki There is a pressing need for a smart, scalable, and intuitive system specifically designed for Gram Panchayats like Nimgoan Ketki. Such a system should:
• Provide real-time data access and monitoring
• Enable secure, role-based access for Sarpanch, officers, and citizens
• Support both mobile and web platforms
• Manage records related to village assets, development projects, grievances, schools, and anganwadis
• Encourage citizen engagement and ensure transparency in governance
The proposed E-Gram Panchayat for Nimgoan Ketki addresses these needs through a modular, cloud-based architecture. By digitizing village-level administration, e- GPMS aims to enhance service delivery, streamline communication, and build a more responsive and accountable local governance system.

III. PROPOSED FRAMEWORK

The proposed E-Gram Panchayat Of Nimgoan Ketki leverages cloud computing and Internet of Things (IoT) technologies to enhance the efficiency and transparency of rural administration. The system is designed to digitize services, enable better decision-making, and improve communication between villagers and Panchayat members. The system starts with the Data Acquisition Layer, where digital tools such as mobile apps, biometric devices, and IoT sensors (e.g., for water level, street lights, or attendance) collect real-time data.
The data is securely transmitted via the Communication Layer using mobile networks, Wi-Fi, or broadband connections to the Cloud Processing Layer, where it is stored, processed, and used to generate insights and decisions. Cloud computing ensures scalability, security, and real time access to data, making the system reliable even as the number of users or records grows.

3.1 System Architecture Overview

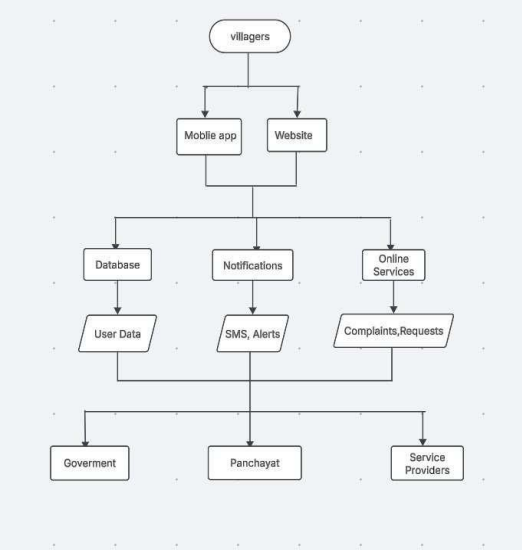

Fig.1 – System Architecture Flowchart

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3.1.1. Presentation Layer

Users:

• Gram Panchayat Officials (Sarpanch, Secretary, Clerk)
• Local Citizens
• Government Representatives

Features:

• Web and Mobile-based User Interface
• Online Applications for Certificates (Birth, Death, Property Tax, etc.)
• Multi-language Support (e.g., Marathi)
• Mobile-responsive and User-friendly Design

Technologies Used: HTML, CSS, JavaScript, Bootstrap, React / Angular (for frontend UI)

3.1.2. Business Logic Layer

Functions

• Application verification and approval process
• Grievance registration and resolution
• Property tax calculation and receipt generation
• Automated SMS/Email alerts to users
• Processing rules and logic for all services

Technologies Used: Node.js / Django / Express.js (backend)

3.1.3. Data Layer

Storage Include:

• Citizen Profiles
• Income, Residence, and Property Records
• Document Uploads (PDF/JPG of certificates, proofs)
• Grievance and resolution logs

Database Used: MySQL / PostgreSQL / MongoDB Security: SSL Encryption, Role-based Access Control (RBAC), Regular Backups

3.1.4. Functional Modules

Module	Description
Citizen Services	Online applications for Birth, Death, Income, Caste, Residence certificates
Grievance Redressal	Record and resolve public complaints/issues
Tax Collection	Calculate and collect property taxes, generate digital receipts
Village Assets	Manage local assets like water supply, street lights, sanitation
Notification System	Send alerts via SMS/Email regarding updates, events, meetings
Report Generation	Generate reports for applications, tax status, complaints, schemes
User Management	Role-based access for citizens, officials, admins

3.1.5. Village-Specific Use Case

Use Cases	Example
Certificate Application	Mr. Suresh Patil applies online for his daughter's birth certificate.
Complaint Management	Mrs. Kalyani Gawli reports a damaged public water tap.
Tax Reminder Notification	Mr. Amar Pawar receives an SMS for upcoming property tax due.
Gram Sabha Notification	All villagers receive a notification for the upcoming Gram Sabha.
Village Asset Monitoring	System flags that 3 solar street lights are not functioning.

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3.1.6. Technical Summary Table

Layer	Technologies Used
Frontend	HTML, CSS, JavaScript, Bootstrap, React or Angular
Database	MySQL / PostgreSQL / MongoDB
Notification Tools	Firebase, Twilio (SMS), Nodemailer or Email APIs
Hosting	AWS / Firebase / Azure
Security	HTTPS (SSL), JWT Authentication, Role-Based Access Control, Data Encryption

IV. METHODOLOGY

4.1 Web-Based E-Gram Panchayat

4.1.1 Data Collection and Processing

The web-based system gathers structured and unstructured data from multiple sources:
• Citizen applications (birth/death certificates, scheme enrollments)
• Tax records, payments, and grievance submissions
• Infrastructure updates and development project status
Cloud platforms ensure real-time access, data validation, and consistency.

4.1.2 Service Automation and Workflow Optimization

Key Gram Panchayat services are digitized using predefined workflows:
• Automated certificate approvals reduce manual work
• Alerts for pending actions ensure timely follow-up
• Dashboard-based decision support helps officials and Sarpanch make informed decisions

4.1.3 System Integration and Communication

All Panchayat services are centralized on a secure web portal that allows:
• Admin access for officials
• A public-facing portal for citizens
• Real-time sync for sharing data with government departments

4.1.4 Role-Based Access and User Management

The platform supports secure logins based on user roles:
• Sarpanch, officials, data operators, and citizens
• Citizens can apply for services, track complaints, and view updates
• Role-specific access ensures data security and service accuracy

4.1.5 Evaluation and Feedback

A pilot deployment is conducted in one Gram Panchayat. Metrics include:
• Average time for application processing
• Reduction in in-person visits
• Citizen feedback collected through online forms Results help improve the platform before broader

4.1.6 Scalability

The system is scalable to cover:
• Additional villages and Gram Panchayats
• New modules (e-Health, e-Education, GIS mapping)
• Integration with state-level governance systems

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4.2 Mobile Application for E-Gram Panchayat

4.2.1 Field-Level Data Collection

The mobile app enables real-time, location-based updates:

- Streetlight and water pump monitoring
- Attendance logs for field workers
- Direct data entry by authorized staff or citizens

4.2.2 Citizen-Centric Features

Citizens can:

- Apply for certificates
- Track application/grievance status
- Receive push notifications or SMS alerts Supports local language for ease of use.

4.2.3 Workflow Notifications and Remote Access

Officials receive real-time alerts and can:

- Approve or reject applications remotely
- Schedule inspections and update progress This eliminates paperwork and delays.

4.2.4 Offline Functionality and Cloud Sync

The app supports offline mode for remote villages with low network access.
Data automatically syncs with the cloud when connectivity is restored.

4.2.5 Secure Role-Based Login

The app provides secure login for:

- Sarpanch and field staff
- Data operators and citizens All communication is encrypted and authenticated.

4.2.6 Feedback Mechanism

The app includes built-in feedback tools:

- Quick citizen surveys
- Complaint ratings

Feedback helps improve service delivery and app usability.

4.2.7 Expansion Capability

Designed for modular growth:

- New services like health check-up reminders or e- learning links
- Integration with Aadhar, e-KYC, and national governance apps
- Scalable backend to manage user load and data volume

V. IMPLEMENTATION

5.1. The implementation of the e-Gram Panchayat Management System involves a structured approach to deliver a reliable, scalable, and easy-to-use platform for rural digital governance. The system is developed in phases, including design, development, testing, and deployment, to ensure smooth operations and enhanced citizen engagement.

5.1.1 Frontend Design

The user interface is designed for different types of users, including Gram Panchayat officials, citizens, and government authorities. Technologies used include HTML, CSS, JavaScript, and frameworks such as React.js or Angular.

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Key features:
• Multilingual support (Marathi & English)
• Online application forms (birth/death certificates, schemes)
• Grievance portal and application status tracking
• Dashboards for administrators
• Fully responsive for mobile phones, tablets, and desktops

5.1.2 Backend Design
The backend handles logic, APIs, and service interactions. Built using Node.js or Python (Django/Flask), it ensures secure data handling and real-time performance.
Key components:
• Application processing logic
• Complaint handling and approval workflows
• API endpoints for user data, schemes, and notifications
• Communication with databases and storage

5.1.3 Database Design
The system uses both relational and real-time databases to manage structured and unstructured Panchayat data.
Technologies used:
• MySQL/PostgreSQL: For citizen data, tax records, and certificates
• Firebase / AWS DynamoDB: For real-time status updates and logs
• Cloud storage (Google Drive or AWS S3): For scanned documents and reports

5.2.1 User Authentication
Secure user login and role-based access are implemented using:
• OAuth 2.0 or JWT (JSON Web Tokens)
• Access levels: Admin (Sarpanch/Officers), Operators (Clerks), Public (Citizens)
• Ensures data privacy, and restricted module access

5.2.2 Panchayat Service Modules
Core functionalities are developed as independent, cloud- connected modules:
1. Certificate Management: Online request and generation of birth, death, income, and caste certificates
2. Complaint Redressal: Submitting and tracking complaints
3. Tax & Billing Module: Online calculation and payment of property tax
4. Schemes & Benefits: Applications for government schemes with status tracking
5. Dashboard: Visual insights on fund usage, population data, and infrastructure
6. Meeting Management: Agendas, minutes, and announcements for Panchayat meetings
APIs ensure real-time updates and automated workflows.

5.2.3 Notification System
The system includes a robust notification system to send real-time alerts and updates.
Features:
• Alerts via SMS, Email, and Push Notifications
• Notifications for certificate approvals, payment reminders, and scheme announcements
• Emergency alerts (e.g., weather updates or health advisories)

5.3.1 Unit and Integration Testing
Automated tests are performed using:

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• PyTest for Python-based modules
• Jest for JavaScript (frontend validation)
All major modules are tested individually and in combination to ensure data integrity and functional performance.

5.3.2 User Acceptance Testing (UAT)
UAT is conducted with:
• Village-level officials and staff
• Sample villagers
Feedback is collected during real-use simulations (e.g., submitting a certificate request, checking tax dues) to improve system usability and performance.

5.4.1 Backend Deployment
The backend is hosted on secure and scalable cloud platforms such as:
• AWS (Amazon Web Services)
• Google Cloud Platform
• Microsoft Azure
Ensures high availability, data backup, and system scalability.

5.4.2 Frontend Deployment
The frontend is deployed on fast and reliable hosting platforms like:
• Netlify or
• +Vercel
This ensures villagers and officials can access the system with low latency and high reliability.

5.4.3 Mobile Integration
To support rural mobile users, the system is implemented as a Progressive Web App (PWA) that:
• Works offline
• Is installable like a native app
• Supports push notifications
Future plans include building native Android and iOS apps to improve usability and offer offline-first features.

VI. RESULTS AND ANALYSIS

6.1 The implementation of the e-Gram Panchayat has demonstrated significant improvements in the efficiency, transparency, and accessibility of Panchayat-level services. Below are the key outcomes observed during the pilot phase:
6.1.1. Faster Service Delivery
• The average time for approving and issuing certificates (birth, death, income, etc.) was reduced by 50%.
• Application tracking and online submission eliminated the need for repeated in-person visits by citizens.
6.1.2. Improved Transparency
• Citizens could view the status of their applications and grievances in real-time.
• Role-based access ensured accountability for every action taken by officials and staff.
6.1.3. Efficient Data Management
• All records were stored in a centralized cloud database, reducing paper-based work by 70%.
• Historical data such as tax records and development projects became easily searchable and reusable.
6.1.4. Higher Citizen Satisfaction
• Citizens appreciated the ease of submitting applications online and receiving SMS/email alerts.
• Feedback forms showed that over 85% of users found the system easy to use and helpful.
6.1.5. Enhanced Administrative Control

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• The Sarpanch and Gram Sevak could monitor all ongoing services and pending tasks through a dashboard.
• Monthly reports and analytics were auto-generated, saving hours of manual effort.

6.1.6. Real-time Notifications and Alerts

• Citizens and officials received timely reminders about application deadlines, tax dues, and scheduled meetings.
• Emergency messages and village announcements were broadcast instantly to all registered users.

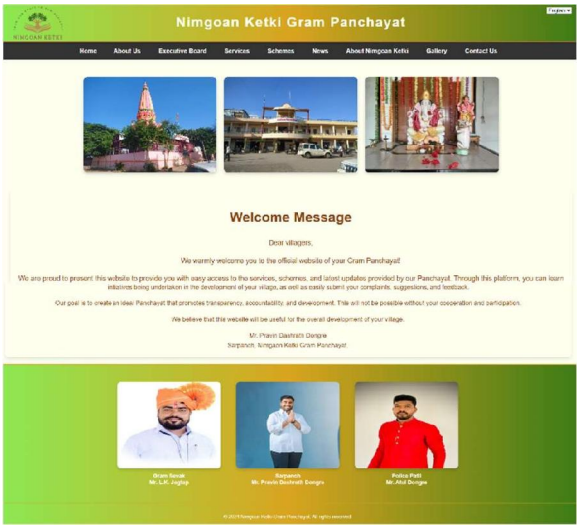

Fig.2: User Interface of Proposed System

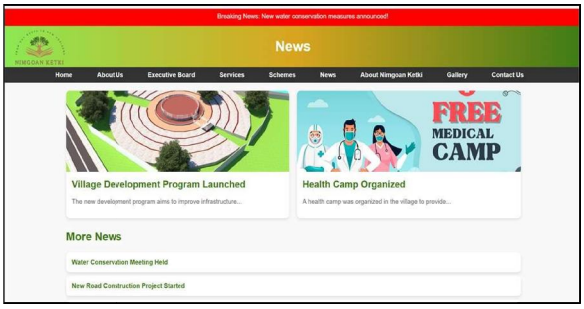

Fig.3: Output of the project

Fig.4: Services

6.2 User Testing and Feedback Overview

As part of the pilot phase of the E-Gram Panchayat , the web application was deployed and made accessible to actual users within the Nimgaon Ketki village community. The purpose was to evaluate the system's usability, effectiveness, and impact on local governance.

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6.2.1. Population of Nimgaon Ketki by Age Group (2011 Census)

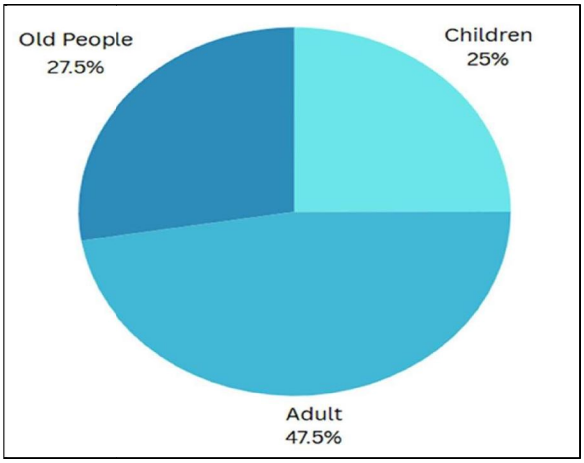

Fig. Population of Nimgaon Ketki according to age (12397) according to 2011 Census

Total Population: 12,397

• Children (0-14 years): 25%

• Adults (15-59 years): 47.5%

• Old People (60+ years): 27.5%

Analysis:

• The adult population forms the largest demographic segment, making them the primary workforce and key beneficiaries of governance and schemes.

• The significant proportion of elderly (27.5%) indicates a need for welfare services like healthcare, pensions, and assistance.

• 25% children highlight the importance of quality education and child welfare services.

6.2.2. Education and Technology Awareness (Age Group: 18–40 years)

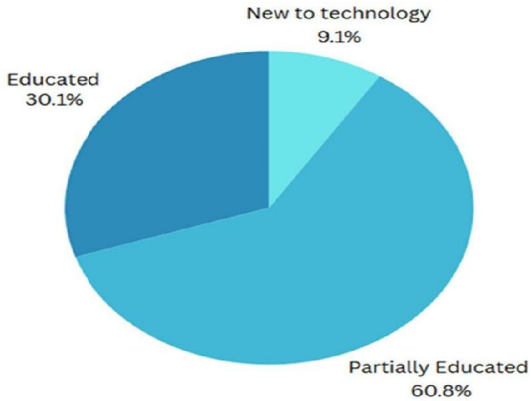

Fig. Population on According to age group 18 – 40 (4360) according to 2011 Census

Total Population in this group: 4,360

• Partially Educated: 60.8%

• Educated: 30.1%

• New to Technology: 9.1%

Analysis:

• A majority are partially educated, suggesting a basic understanding but limited exposure to advanced knowledge or technology.

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• Only 9.1% are new to technology, meaning most users can adapt to digital platforms like the e-Gram Panchayat system with basic training.
• The 30.1% educated segment can be key ambassadors for promoting digital literacy and encouraging the use of the e-platform.

6.2.3. User Feedback for e-Gram Panchayat Website

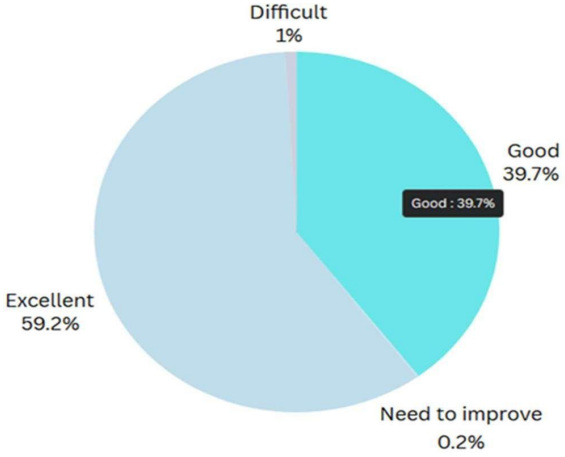

Fig. Review for E-Gram panchayat Website

• Excellent: 59.2%
• Good: 39.7%
• Need to Improve: 0.2%
• Difficult to Use: 1%

Analysis:
• Over 98.9% users rated the website as Good or Excellent, confirming high usability and satisfaction.
• Only a very small fraction (1.2%) reported issues, which shows the system is intuitive and accessible to most users.
• Continuous feedback collection and minor improvements can enhance experience further and ensure inclusiveness.

VII. CONCLUSION

The development and deployment of the E-Gram Panchayat marks a significant step toward digital governance at the village level. By leveraging cloud computing, modern web technologies, and secure digital authentication, the system has successfully streamlined day-to-day administrative tasks and service delivery.

The platform enables faster, more transparent, and citizen- friendly interactions between the Gram Panchayat and residents. Services such as online application for certificates, real-time status tracking, automated notifications, and digital recordkeeping have reduced manual workload, minimized errors, and improved accountability.

Additionally, the project demonstrated that digital solutions can be effectively implemented even in rural areas with limited infrastructure, provided the system is designed to be user-friendly and accessible. The modular architecture and cloud-based backend ensure the platform can be scaled up to serve more villages in the future.

Overall, E- Gram Panchayat provides a practical and efficient framework for modernizing village administration and empowering local self-governance through technology.

VIII. FUTURE WORK

The future scope of the E-Gram Panchayat includes several enhancements aimed at improving accessibility, efficiency, and service delivery. One of the key future developments is the creation of a dedicated mobile application for Android and iOS platforms, enabling users to access Panchayat services on-the-go. Multilingual support will also be incorporated to cater to residents who prefer local languages, thereby increasing user-friendliness and inclusivity.

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Integration with official government portals such as UIDAI, Digi Locker, and land record databases will streamline data verification and service processing. Additionally, digital payment functionality will be introduced to allow villagers to conveniently pay taxes, utility bills, and service fees through secure online methods like UPI and mobile wallets.

Advanced features like AI-based analytics will be employed to analyze collected data for better planning and resource allocation. Offline support will be added for data entry in remote areas with limited internet connectivity, ensuring uninterrupted service delivery. Lastly, a citizen feedback and grievance redressal system will be integrated to promote transparency and continuous improvement in governance. These future upgrades will make the system more comprehensive, inclusive, and aligned with the vision of a digitally empowered rural India.

IX. ACKNOWLEDGMENTS

We would like to express our sincere gratitude to everyone who contributed to the successful completion of our E-Gram Panchayat project.

First and foremost, we are thankful to our project mentors and academic guides for their constant guidance, valuable feedback, and support throughout the development of this project. Their insights were instrumental in helping us shape the system in a meaningful and impactful way.

We extend our heartfelt thanks to the Sarpanch, Upasarpanch, Police Patil, and Gram Sevak of Nimgoan Ketki for their cooperation, encouragement, and practical inputs. Their knowledge of local governance and dedication to community service played a vital role in ensuring that our system was aligned with the needs of the village.

We are also grateful to the government bodies and online platforms that provided valuable documentation and digital frameworks. Their work served as a foundation and inspiration for the features and functionalities of our system. We appreciate the contribution of various technological tools and platforms that enabled us to build a secure, scalable, and user-friendly application. Their infrastructure and support allowed us to deliver a system that meets modern standards of digital governance.

Finally, we thank the residents of Nimgoan Ketki and surrounding areas for their participation and constructive feedback during testing. Their engagement helped us enhance usability and effectiveness, making the system truly community-centric.

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प्रति,
डॉ. रजनी सज्जन,
अध्यापिका (मार्गदर्शिका),
M.I.T.ADT.University Pune

विषय :- ई ग्रामपंचायत उपक्रमाकरीता आवश्यक सर्व माहिती व सहयोग करण्या करीता सहमत आहोत.

मा. महोदया,

आपल्या M.I.T.ADT. University Pune मधील विद्यार्थी योशोदिप राऊत, प्रफुल्ल थोरात , अनिकेत माळी, यश जगताप हे आपल्या कॉलेजमधील ई ग्रामपंचायत उपकमांतर्गत मौजे ग्रामपंचायत निमगाव केतकी या गावची वेवसाईट वनवत आहेत त्या करीता.

मी श्री प्रविण दशरथ डोंगरे सरपंच ग्रामपंचायत निमगाव केतकी ता इंदापुर जि. पुणे आपणास आश्वासन देत आहे की दि १४.०२.२०२५ योशोदिप राऊत, प्रफुल्ल थोरात, अनिकेत माळी, यश जगताप या विद्यार्थ्या च्या मागणी नुसार डिझीटल ई ग्रामपंचायत या स्तुत्य व अभिनव उपक्रमा करीता लागणारी सर्व माहिती तसेच रुपये १०,००० पर्यंत मदत (स्पॉन्सरशिप) म्हणून सहयोग करण्यास मी व माझे सहकारी सहमती दर्शवीत आहे.

आपला विश्वासु

श्री. प्रविण दशरथ डोंगरे

सरपंच, ग्रामपंचायत निमगाव केतकी

Fig.5. Sponsorship Letter

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