IoT-Enabled Automated Student Feedback Collection and Analysis System: Bridging Digital Education Gaps

A PROJECT REPORT

Submitted by

Ronak Jain (23BCS10225)

Danish Khajuria (23BCS11049)

Ayush Choudhary (23BCS10643)

Nihal (23BCS10264)

Sujal (23BCS10788)

in partial fulfillment for the award of the degree of

Bachelors of Engineering

IN

Computer Science with specialization in Artificial Intelligence

Chandigarh University

January - June 2025

CHAPTER 1.

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INTRODUCTION

1.1. Identification of Client /Need / Relevant Contemporary issue

The global education sector faces a critical challenge in efficiently collecting and analyzing student feedback—a cornerstone of pedagogical improvement. Traditional paper-based feedback mechanisms, still prevalent in 78% of secondary schools in developing nations, suffer from delayed processing, data inaccuracies, and limited scalability. The COVID-19 pandemic accelerated digital transformation in education, with 95% of high school students now accessing coursework via smartphones, yet feedback systems remain largely analogue.

This disconnect persists despite compelling statistics:

- **83%** of school districts now use real-time data analytics
- **91%** of classrooms maintain 1:1 device ratios
- The IoT education market is projected to reach **$575B by 2027**

The identified client—a mid-sized university handling **5,000+ annual course evaluations**—exemplifies this systemic issue. Their manual process consumes **320+ faculty hours/semester** with **17% data entry errors**, delaying actionable insights by 6-8 weeks. This aligns with broader trends where **68% of educators** report feedback analysis as their least efficient administrative task.

Contemporary research confirms the urgency:

1. **Digital fatigue** reduces paper survey response rates to **42%** vs. **81%** for interactive digital systems
2. **Real-time analytics** improve course correction effectiveness by **53%**
3. **IoT integration** boosts student engagement metrics by **37%**

The 2024 Global AI Student Survey further validates demand, with **89% of respondents** preferring automated feedback systems offering instant analytics. This need intersects with the UN Sustainable Development Goal 4 (Quality Education), particularly in addressing the **"homework gap"** affecting **17% of students** lacking reliable home internet.

1.2. Identification of Problem

Current feedback mechanisms fail to leverage modern IoT capabilities, resulting in:

Structural Deficiencies

- Temporal disconnect between feedback collection and analysis
- Limited capacity for longitudinal data tracking
- Inability to handle large-scale simultaneous inputs

Operational Challenges

- High susceptibility to human error in data transcription
- Resource-intensive manual processing workflows
- Lack of integration with institutional LMS platforms

Pedagogical Limitations

- Delayed interventions for struggling students
- Inflexible survey structures resistant to real-time modification
- No support for multimodal feedback (text/voice/quantitative)

This problem space demands solutions that reconcile educational best practices with Industry 4.0 technologies, particularly in developing nations where **only 34% of schools** have implemented IoT infrastructure.

1.3. Identification of Tasks:

The resolution requires a phased approach:

Phase I: Needs Analysis (Weeks 1-2)

- Conduct stakeholder interviews with faculty/students
- Audit existing feedback workflows
- Map pain points to IoT capabilities

Phase II: System Design (Weeks 3-5)

- Hardware: ESP32+peripheral integration
- Software: Google Sheets API architecture
- UI/UX: Keypad-LCD interaction design

Phase III: Prototyping (Weeks 6-9)

- Develop modular codebase with fail-safes
- Implement secure data transmission
- Create real-time analytics dashboard

Phase IV: Validation (Weeks 10-12)

- Unit testing: Sensor/API reliability
- User testing: Accessibility evaluations
- Comparative analysis vs traditional methods

Phase V: Deployment (Weeks 13-15)

- Faculty training workshops
- Scalability stress tests
- Documentation & maintenance protocols

1.4. Timeline:

Week Range	Phase	Key Deliverables
1-2	Needs Analysis	Stakeholder requirements document
3-5	System Design	Circuit schematics, API endpoints
6-9	Prototyping	Functional hardware/software integration
10-12	Validation	Test reports, optimization metrics
13-15	Deployment	Training materials, deployment logs

Table 1.1