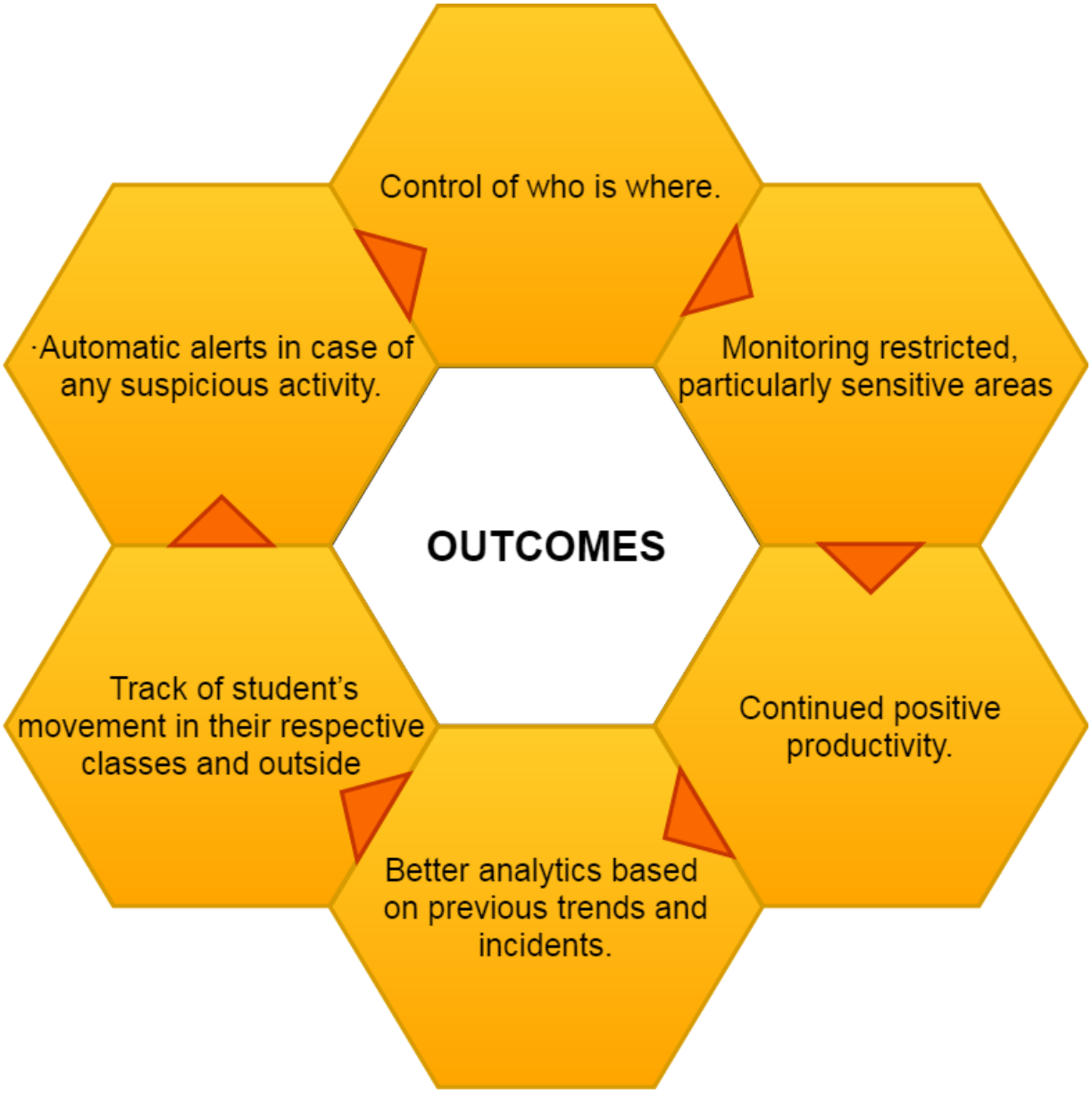
STUDENT MONITORING SYSTEM

VISION

"TO CREATE A SAFE AND SECURE ENVIRONMENT FOR THE STUDENT BOTH INSIDE AND OUTSIDE THE SCHOOL PREMISES AND ALSO TO ENSURE BETTER RESOURCE PLANNING FOR THE INSTITUTE THUS ENHANCING THE PRODUCTIVITY"



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Executive Summary

The project intends to improve the security system in schools and colleges and accelerate progress by ensuring proper resource planning so as to deliver a quality environment for students worldwide. The project aims to create a "***Safe and secure atmosphere***" that not only ensures the safety of a student but also enhances the productivity of the institution.

The project focuses on addressing existing challenges and achieving the objectives of a secure environment

A lot of school administrators are uncertain about embracing this system to their schools. A few of them mention student privacy as the primary reason for concern. Others are just scared to accept new innovation. Concerns related to the health risks associated with the new surveillance system are also undeniable. People say that the system technology is like exposing children to a low power micro-wave oven for more than 6 hours. This may turn out to be hazardous to health. Also, with acute shortage of seats in Indian schools, parents have found themselves forced to pay for the new identification tag, which cost QR1,200 per child a year. Also, the CCTV cameras installed for monitoring are not able to capture quality footage and might miss several important details that should not be ignored.

These challenges were analyzed further and summarized in the form of outcomes to be achieved through the Student Monitoring System.

Based on the above outcomes, the following Architecture Vision was established for the project

"To create a safe and secure environment for the student both inside and outside the school premises and also to ensure better resource planning for the institute thus enhancing the productivity''

One of the first steps in developing the Architecture was to establish the Business Architecture and define the high-level Information System needs. This involved identification of the stakeholders and defining the high-level information systems requirements they have. This is detailed in the Business Architecture artefact presented below.

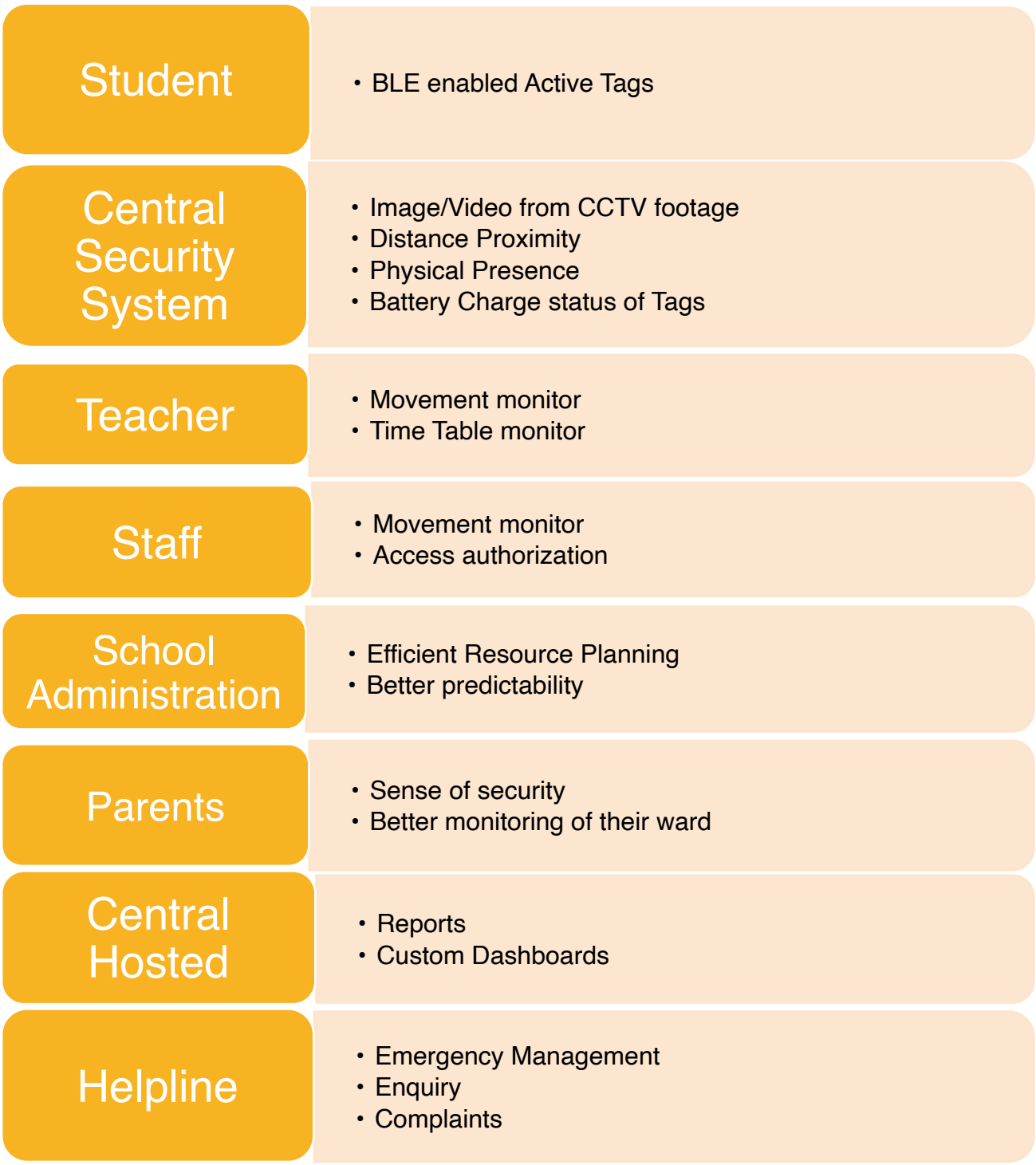


Figure 1 Business Architecture and Information System Needs

1. Introduction

The project seeks to create a safe and secure environment for the student and parallelly help accelerate productivity of the institute by helping in better resource planning. The data collected can also be analyzed to make future plans and apply intelligence to the various systems.

1.1. Objectives of the Student Monitoring System

The system is considered to supply extra security to students and make the management in every context, less complicated for the school authorities. Student tracking systems are slowly however progressively getting appeal all over the world. As each year passes, an increasing number of schools are releasing obligatory identity cards which work accordingly with the BLE Technology.
By considering such a system an organization may be able to rule out a variety of problems encountered almost every day.

The Student Monitoring System has the following outcomes

- Keeping control of who is where.
- Monitoring restricted, particularly sensitive areas for safety reasons, and the movement of unauthorized people to these areas.
- Automatic alerts in case of any suspicious activity.
- Keeping track of student's movement in their respective classes and outside.
- Keeping a check on the staff to ensure continued positive productivity.
- Formulating and applying better analytics based on previous trends and incidents.

The outcomes are defined as

OUTCOMES	DESCRIPTION
Keeping control	• The system keeps an eye on each and every movement within the campus to ensure the safety of students.
Monitoring restricted, particularly sensitive areas	• Areas which are not authorized for every individual are monitored closely.
Automatic alerts	• Any suspicious activity anywhere within the campus leads to generation of automatic alerts. • Cameras are activated to capture the unwonted activities.
Keeping track of students in their respective classes	• From the moment when the student enters the school premises, his/her movement is monitored according to the time table. • This eliminates the possibility of class bunk an also covers the security aspects.
Ensuring continued positive productivity	• The installed BLE Beacons along with the cameras also monitor faculties and staff members so as to ensure the productivity of the institute.
Better Analytics	• Based on movements and trends better analytics can be applied. • This helps in better decision making and smart systems.

1.2. About the report

The report enlists the current scenario of security systems in India and worldwide. The report also elaborates the strategy and formulates a roadmap for the Student Monitoring System.

It also exhibits how our system is different and unique from the existing systems worldwide and also portrays the architectural vision and principles. The implementation plan along with the cost estimates is shared keeping the benefits of the system in focus.

2. Background and Context for the Student Monitoring System

This chapter establishes the background and context for the Student Monitoring System developed for enhancing the security of students within the school campus and the challenges that need to be addressed keeping in mind the already existing systems.

2.1. Current student security structure worldwide

Schools use a variety of practices and procedures to promote the safety of students, faculty, and staff. Certain practices, such as locking or monitoring doors and gates, are intended to limit or control access to school campuses, while others, such as the use of metal detectors and security cameras, are intended to monitor or restrict students' and visitors' behavior on campus.

In the 2015–16 school year, 94 percent of public schools reported that they controlled access to school buildings by locking or monitoring doors during school hours. Other safety and security measures reported by public schools included the use of security cameras to monitor the school (81 percent), a requirement that faculty and staff wear badges or picture IDs (68 percent), and the enforcement of a strict dress code (53 percent). In addition, 25 percent of public schools reported the use of random dog sniffs to check for drugs, 21 percent

required that students wear uniforms, 7 percent required students to wear badges or picture IDs, and 4 percent used random metal detector checks.

Use of various safety and security procedures differed by school level during the 2015–16 school year. For example, greater percentages of public primary schools and public middle schools than of public high schools-controlled access to school buildings and required faculty and staff to wear badges or picture IDs. Additionally, a greater percentage of primary schools than of middle schools required students to wear uniforms (25 vs. 20 percent), and both percentages were greater than the percentage of high schools requiring uniforms (12 percent). The percentage of schools reporting the enforcement of a strict dress code was greater for middle schools (70 percent) than for high schools (55 percent) and primary schools (46 percent). The percentage of schools reporting the use of security cameras to monitor the school was greater for high schools (94 percent) than middle schools (89 percent), and both of these percentages were greater than the percentage for primary schools (73 percent). The same pattern was evident for the use of random dog sniffs and the use of random metal detector checks. A greater percentage of high schools (16 percent) and middle schools (13 percent) than of primary schools (3 percent) required students to wear badges or picture IDs.

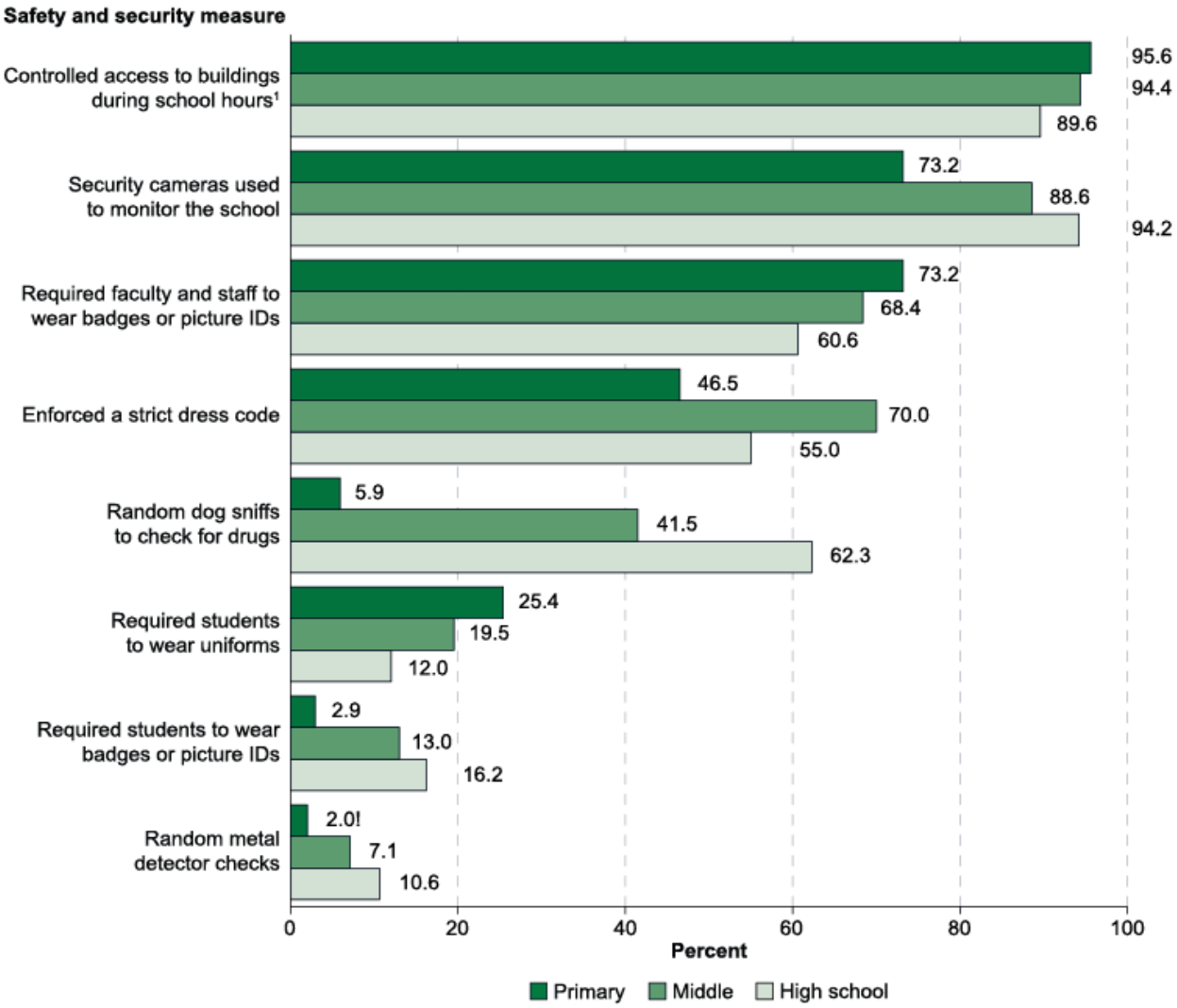


Figure 2 Student Security Structure Worldwide

2.2.Scenario in India

Indian schools are visibly low on safety and security, many schools across the country are yet to install safety and security arrangements. However, in recent times with the infamous incidents that took place, schools all over the world have realized the importance of having a proper security arrangement to meet any such eventualities. Schools are preparing themselves to take necessary precautions and keep strict security checks. All this is being put into place, albeit a little slowly.

The Delhi government has allocated 26% of its state budget to education this year, earmarking Rs 13997 crore in total. This remains higher than mot states in the country and yet over the last budget allocation 23.5% - made by the government.

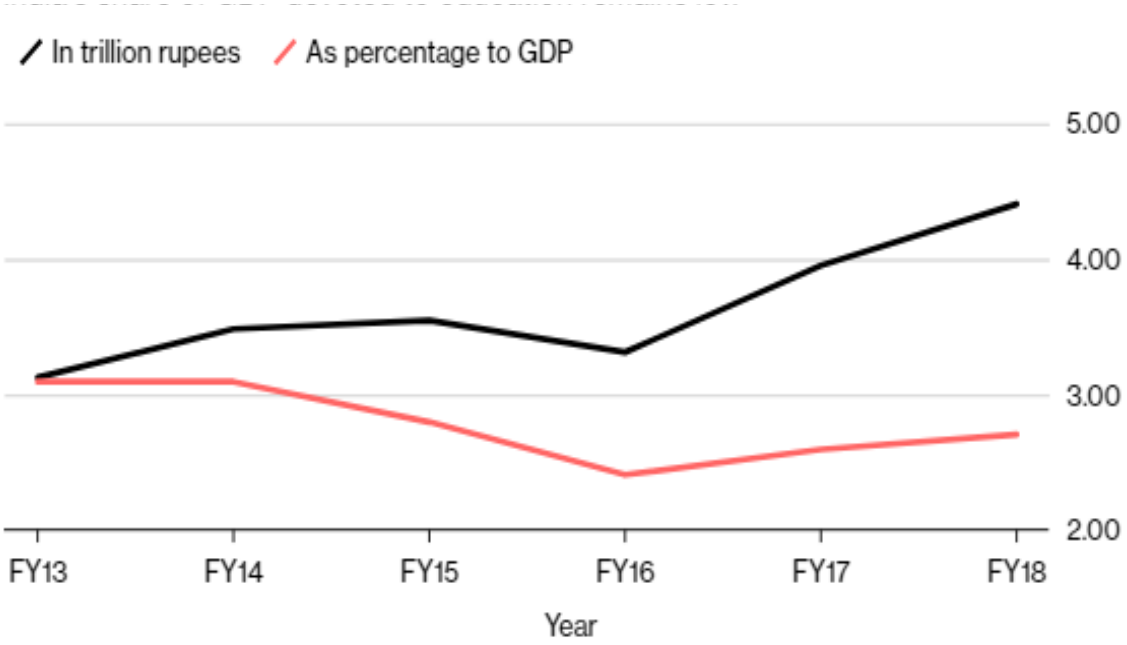
Besides this, the government has proposed to install around 1.2 lakh CCTV cameras across its schools – each with around 150-200- which will allow parents to watch their kids through live stream. The government has allocated Rs 175

crore estimates amount to this end. Also, staff rooms updates are facilitated to keep tabs on teachers.

Spending Shortfall

However, India's share of GDP devoted to education remains low thus limiting the funds for security in schools.

India’s public education spend as a percentage of GDP is the lowest among its peers, according to BRICS Joint Statistical Publication 2017.



Source: Economic Survey 2017-18

*The figures are of the public spending of federal government and states * FY17 and FY18 figures are provisional

Figure 3 Spending Shortfall

2.3.Need Assessment

For the purpose of this report, we look at security as a complex parameter for all schools and colleges. Security of students is one such critical factor which has been degrading gradually with the increase in crimes. Better security measures have to be delivered for a sound and safe environment around the student.

Better implementation of these security systems depends on the following components.

- Keeping control movement of people within the campus.
- Monitoring restricted, particularly sensitive areas for safety reasons, and the movement of unauthorized people to these areas.
- Automatic alerts in case of any suspicious activity.
- Keeping track of student's movement in their respective classes and outside.
- Keeping a check on the staff to ensure continued positive productivity.
- Formulating and applying better analytics based on previous trends and incidents.

2.4.Current Systems in Schools

Tturk

TTURK is a culmination of thought process towards addressing prevailing issues of Student Safety and Tracking. This led to the expectation of information updates for parents right from the child steps out from home to school and returns back.

Way back in late 2000's this project was designed & engineered with RFID (Radio Frequency Identification) tags and gate antennas. Owing to the practical difficulties in deployment under Indian atmosphere like (more students, limited/ small school passages, need for antennas in each gate, tap & go cards, cost of deployment) were the deterrents then, which made the project to be shelved.

Presently, with the advent of new technologies like Bluetooth Low Energy (BLE), Internet of Things (IoT), has addressed the concerns and also made the solution more robust, agile and easy to deploy.

3. Framework for strategy development

The roadmap for Student Monitoring System uses a structured methodology for development of Enterprise Architecture- which is typically modelled at four levels: Business, Application, Data, and Technology – and its implementation is based on four interrelated areas of architecture domains:

- Business architecture which defines the business strategy, organization, and key business processes of the organization

- Applications architecture which provides a blueprint for the individual application systems to be deployed, the interactions between the application systems, and their relationships to the core business processes of the organization with the frameworks for services to be exposed as business functions for integration

- Data architecture which describes the structure of an organization's logical and physical data assets and the associated data management resources
- Technology architecture, which describes the hardware, software, and network infrastructure needed to support the deployment of core applications

Phases	Activity performed as part of this engagement
Requirements Management	Every phase has to validate business requirements. Requirements are identified, stored, and fed into and out of the relevant phases, which dispose of, address, and prioritize requirements.
Phase A: Architecture Vision	Set the scope, constraints, and expectations for engagement. Create the Architecture Vision. Define stakeholders. Validate the business context.
Phase B: Business Architecture **Phase C:** Information Systems Architectures (Application & Data) **Phase D:** Technology Architecture	Develop architectures at three levels: 1. Business 2. Information Systems 3. Technology In each case, develop the Baseline and Target Architecture and analyze gaps.
Phase E: Opportunities & Solutions based on the design	Perform initial implementation planning and the identification of delivery vehicles for the building blocks identified in the previous phases. Identify major implementation projects, and group them into Transition Architectures.

Phase F: Assessment and Testing (UAT)	Analyze cost benefits and risk. Develop detailed Implementation and test the software to make sure it can handle required tasks in real-world scenarios, according to specifications.
Phase G: Deployment of solution	Provide architectural oversight for the implementation. Prepare implementation plan. Ensure that the implementation project conforms to the architecture.

4. Architecture and Implementation

4.1. Architecture vision, architecture principles and reference standards

The Architecture Vision is created in the engagement lifecycle to provide a high-level, aspirational view of the end state. The purpose of the vision is to agree at the outset what the desired outcome should be for the architecture, so that architects can then focus on the critical areas to validate feasibility. Architecture vision is prepared after the consultation from the stakeholders and the architecture vision for this engagement is listed below.

The Architecture Vision of the Student Monitoring System is to "**To create a safe and secure environment for the student both inside and outside the school premises and also to ensure better resource planning for the institute thus enhancing the productivity"**.

The Architecture Vision has been articulated keeping in view the key stakeholders of the program who will be involved with and benefited from the program. The key stakeholders are:

- Students

- School Administration
- Teachers and other Staff Members
- Parents
- Project Management Unit

Architecture principles define the underlying general rules and guidelines for the use and deployment of all IT resources and assets across the institution. They reflect a level of consensus among the various elements, and form the basis for making future IT decisions. The key architecture principles developed for the Student Monitoring System are:

- Ease of use
- Performance
- Security
- Scalability
- Information accessibility and sharing

Principles	Details
Ease of use	Applications developed should be easy to use. The underlying technology is transparent to users, so they can concentrate on tasks at hand.
Performance	The system should provide fast and steady response. The speed and efficiency of the system should not be affected with growing volumes
Security	The security standards should be met according to the predefined guidelines.

Scalability	All components of the system must support scalability to provide continuous growth to meet the requirements and demand. A scalable system is one that can handle increasing number of requests without adversely affecting the response time and throughput of the system.
Information accessibility and sharing	Wide access to information leads to efficiency and effectiveness in decision-making. Also, restricting valuable information to authorized people is one important factor.

4.1.1. Compliance with Industry Standards

The system shall be based on or compliant with industry standards wherever applicable. This applies to all the aspects of system including but not limited to design, development, security, installation, and testing. Following are some relevant standards that should be considered during implementation.

S No.	Areas	Specifications
1	Project Management and Development Standards	
2	IT Infrastructure Management	
3	Service Management	
4	Project Documentation	
5	Security Standards	
6	Hardware and Software Standards	
7	Compatibility	
8	Operational Integrity Management	

4.2.Technology Architecture

4.2.1. Key Components

The camera is a module to capture frames
Blue Tooth is a low Energy (2.4GHz) module
A processing unit and control unit comprising of an antenna module with Re-chargeable lithium-ion/polymer battery
A data storage module comprising of flash memory, SD card or micro-SD card
USB interface for plugging in internet modem activity display LED indicators
An advanced Camera device comprising of a Bluetooth Low Energy or Bluetooth smart module • Camera device embedded with sensor information captured from active tag, in line of sight and blind-spots, information in image and video for transmission and storage • Camera device transmit stores data to a hosted central server for movement pattern establishment, report generation, creation of custom dashboards.

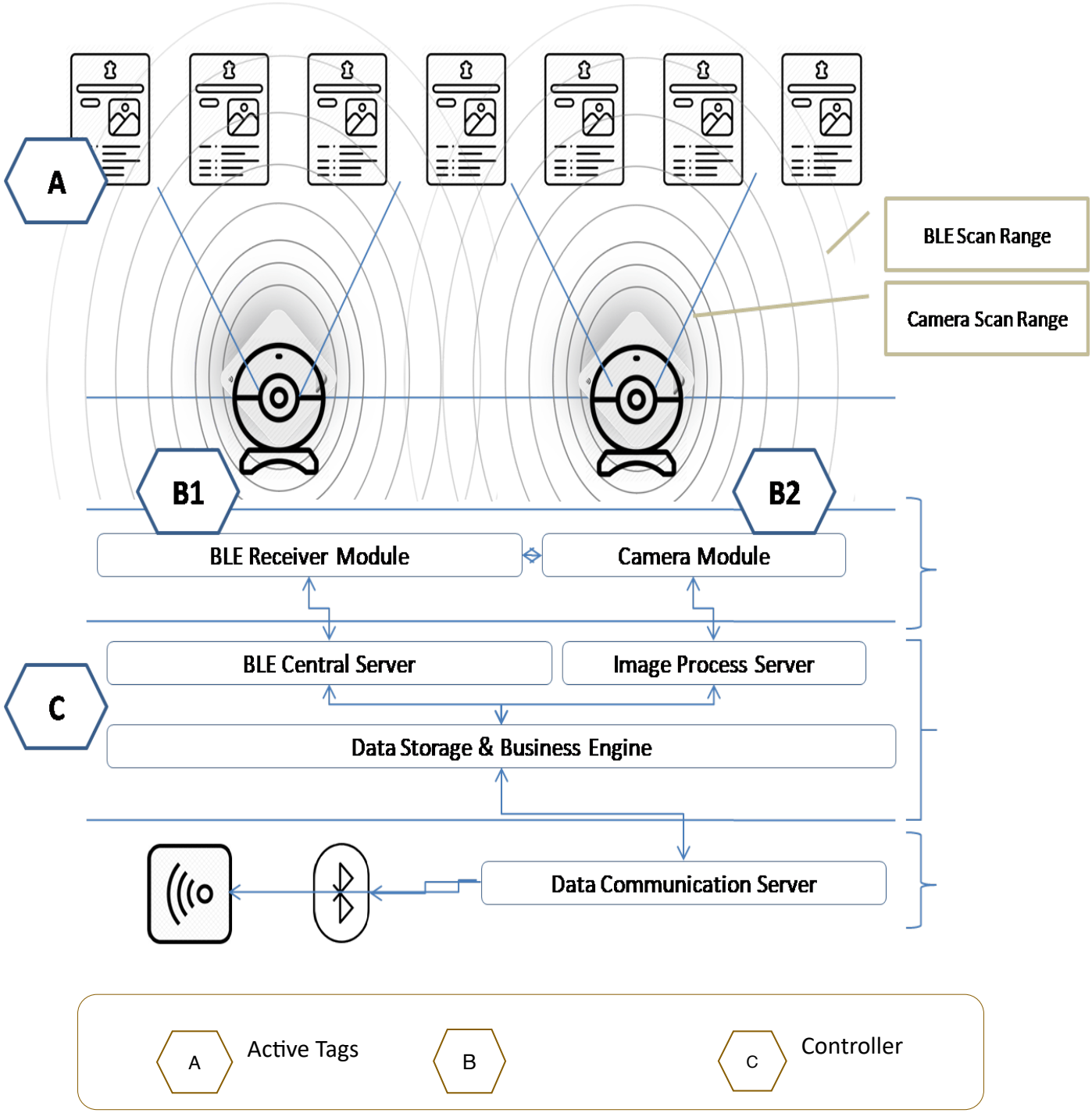
4.2.2. Functions

The technical architecture on which the Student Monitoring System is built consists of three main functions defined below

1. The Autonomous Camera Unit – Comprises of embedded BLE central module to scan, and read raw data from Tags. The data is read in a wider angle forming spherical container around camera module. While, camera captures the image of subject that is present in its current viewing angle.
2. The image frame that is captured using camera module at a given timestamp is merged with the identification of tag as scanned by embedded reader in the module, before transmission to the server for

processing business logic further. This process is also known as Fingerprinting of BLE Tags.

3. Distance calculation of Tag is measured using the Shadowing model utilizing the RSSI of transmitting Tags. The tag firmware is built so as to also advertise its transmission power with every advertisement packet.



4.3.Implementation Plan

To arrive at the implementation plan, the various IT initiatives identified have been prioritized using a Prioritization Framework that considers the Business Impact of the initiatives and the Implementation Complexity. The following sub-factors were considered in each of these two dimensions.

- **Business Impact**: Business Requirements which has three sub-factors:
    - o. Criticality assigned by stakeholders
    - o. Number of stakeholders directly impacted by the proposed solution
    - o. Impact on the improvement in security

- **Implementation complexity**: The ICT solutions proposed are evaluated on the set of the parameters mentioned below for preparing the implementation plan for deployment.
    - o. Time to deploy
    - o. Development efforts to create the solution
    - o. Resource training and capacity building including change management
    - o. Ability to leverage existing infrastructure
    - o. Need to procure new infrastructure

Based on the above dimensions, the IT initiatives were grouped into four categories as depicted in the diagram below.

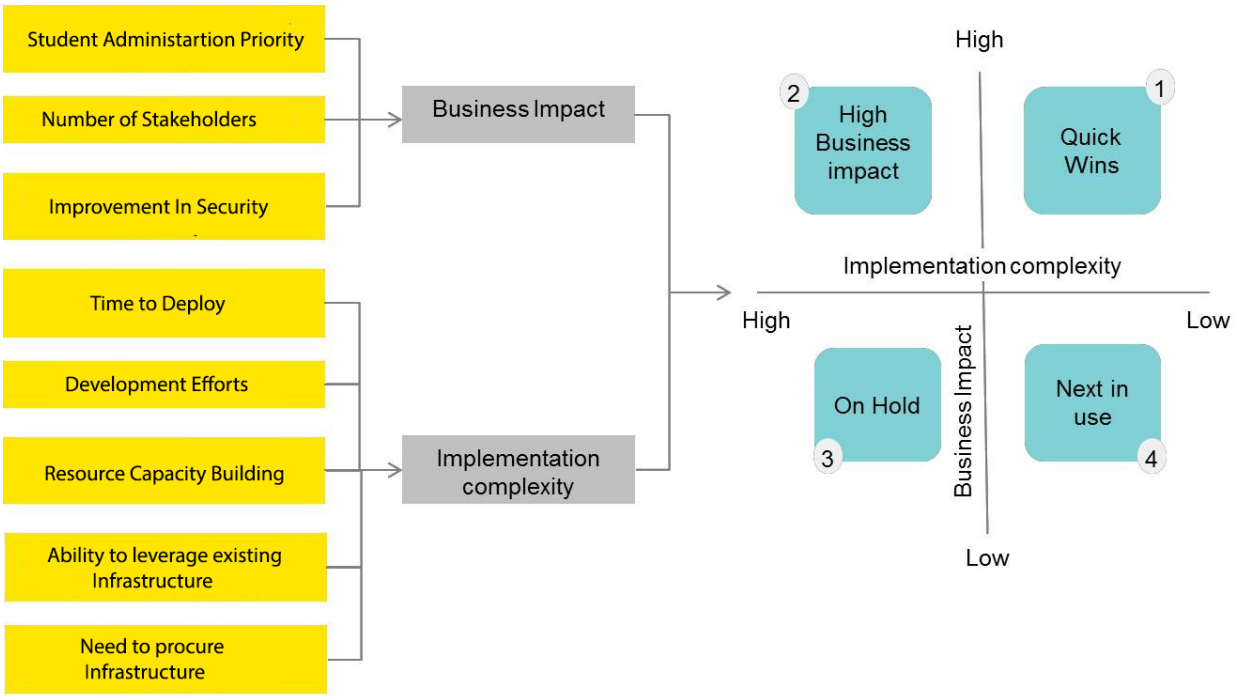


Figure 4 Key Factors of Implementation

After analyzing the Business Impacts and Implementation Complexity we finally work on implementing the system in the environment. This involves one final deployment phase covering the

❖ Installation all hardware

- The **camera** is a module to capture frames
- Blue Tooth is a low Energy (2.4GHz) module - **Beacons**
- A processing unit and control unit comprising of an antenna module with Re-chargeable lithium-ion/polymer **battery**
- A **data storage** module comprising of flash memory, SD card or micro-SD card
- USB interface for plugging in internet modem activity display LED indicators

❖Working on the embedded technology

An advanced Camera device comprising of a Bluetooth Low Energy or Bluetooth smart module

- Camera device embedded with sensor information captured from active tag, in line of sight and blind-spots, information in image and video for transmission and storage
- Camera device transmit stores data to a hosted central server for movement pattern establishment, report generation, creation of custom dashboards.

4.4.High Level Cost Estimates

The cost estimates are based on a portfolio of assumptions and actual costs incurred may vary during implementation. These estimates are intended to be a high-level guidance only to assist in execution of the IT Strategy. These estimates are for duration of five years and account for the following:

- Software license costs for initiatives that need additional software to be procured.
- System implementation effort and the related costs to the initiatives
- High level IT infrastructure costs
- The personnel and operating costs of IT division are not budgeted for in this estimate.
- **Software license costs:** Software license costs have been taken at list prices as available from external publicly available sources for a variety of products that may meet the solution requirements. It is to be noted that these are indicative rates and OEMs/vendors may offer higher or lower prices in the actual implementation.

- **System implementation costs:** The implementation costs have been arrived at based on assumptions on effort required and blended cost rates for system implementation resources. It does not provide for cost escalations, discounts and development environments.
- Out of pocket expenses are not included
- No taxes are included

Please find below a cost heads:

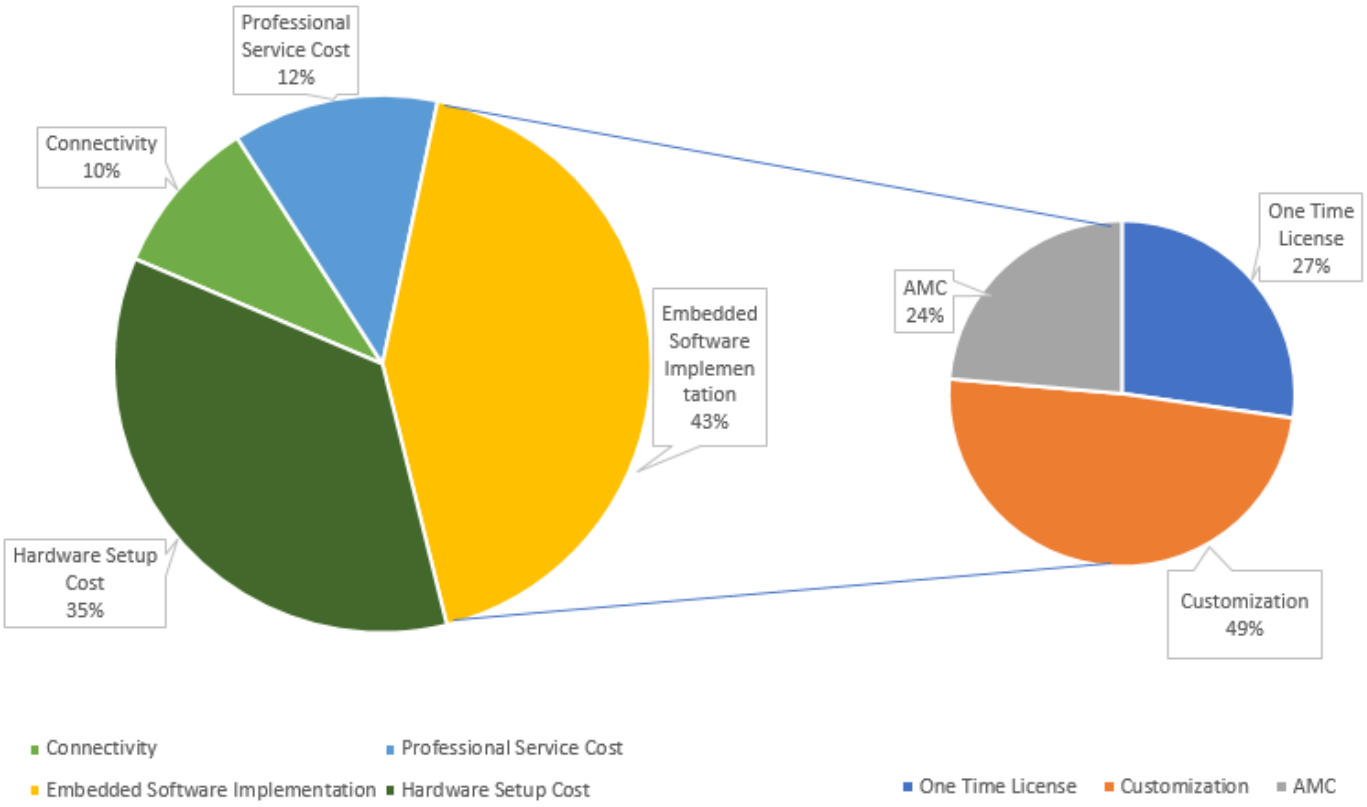
[redacted]
Hardware setup cost
Embedded Software Implementation cost
One-time license cost
AMC
Customization cost
Professional services cost
Connectivity

4.5.Project Management

Scope Management

Project Scope Management includes monitoring and guiding project design efforts so they are compliant with overall project architecture standards and fully facilitate all interface and data sharing requirements. An important aspect

Figure 5 Cost Break-up



of scope control is the program (and projects) change management processes. Program change management governs project changes which could affect the overall project's benefit delivery or has implications. Change requests (or requirements) impacting a project's scope, duration, quality, or costs should be examined to determine whether the change request must be escalated to project-level.

Time Management

Project Time Management involves processes for scheduling the defined components and entities necessary to produce the final project deliverables. It includes determining the order in which the individual components are executed, the critical path for the program, and the milestones to be measured to keep the overall program on track and within the defined constraints. Major

processes include developing the program schedule and monitoring and controlling the program schedule.

Quality Management

Program Quality Management includes all the activities of determining quality policies, objectives, and responsibilities between the program and the projects to ensure the customer's needs are satisfied. Major processes include developing a project-level Quality Management plan, managing the independent validation and verification effort, managing the independent program oversight provider, and performing quality assurance with respect to project standards, and managing continuous process improvement.

Risk Management

Project Risk Management is another critical project management area. Project risk is an event, or series of event or conditions that, if they occur, may affect the success criteria of the project. Positive risks are often referred to as opportunities and negative risks as threats. These risks arise from the components and their interactions with each other, from technical complexity, schedule and/or cost constraints, and with the broader environment in which the project is managed. The main processes are developing the risk management plan, identifying risks, analyzing risks, planning risk responses, and monitoring and controlling risks.

Financial Management

Project Financial Management includes all the processes involved in identifying the project's financial sources and resources, integrating the budgets of the individual processes, developing the overall project budget, and controlling costs

throughout the life cycle of projects and the program. The main processes include establishing the project financial framework, developing the financial plan, estimating program costs, developing the budget, and monitoring and controlling expenditures.

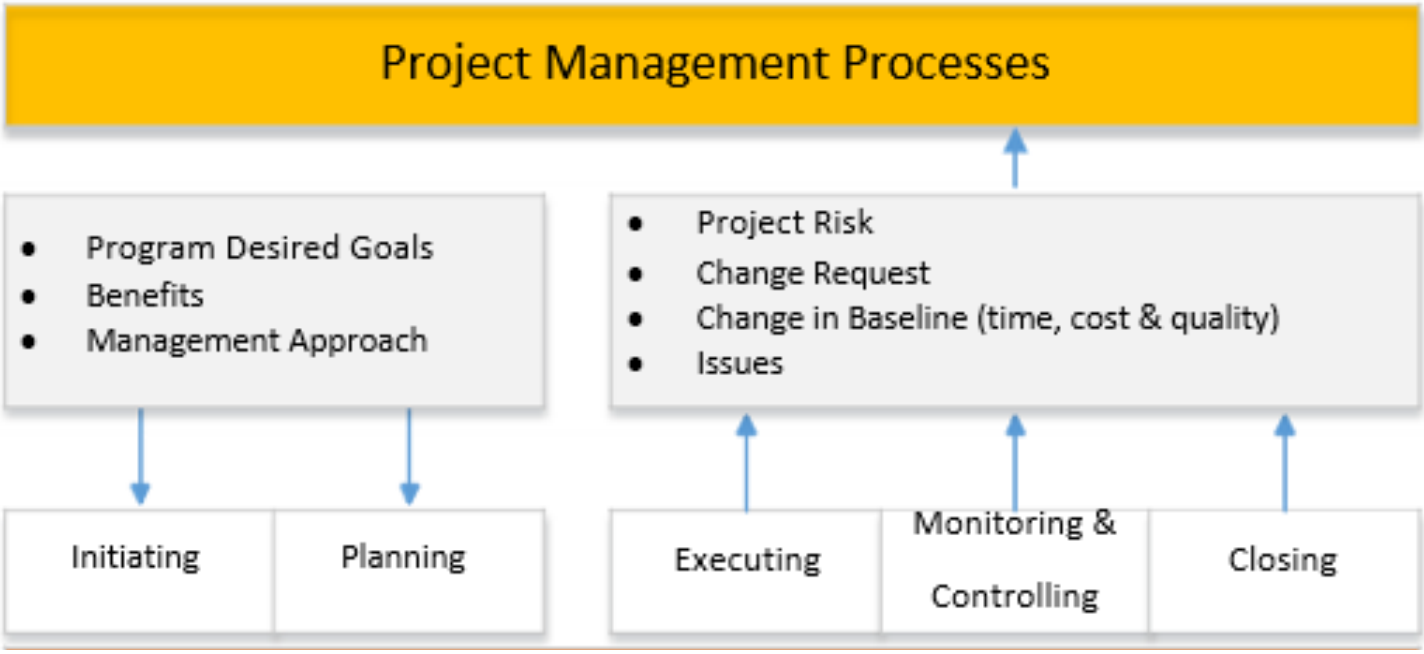


Figure 6 Project Management Process

5. Conclusion

With the increase in number of infamous incidents in schools worldwide, the security of students and staff within the campus remains questioned. The project focuses towards ensuring safety for all, and towards developing a secure and productive environment. The project is expected to usher in a wave of innovative solutions resulting in effective and efficient delivery of security services.

The Student Monitoring System is not just about the implementation of the hardware systems, it is a management solution assisted by the application of technology. Effective user awareness and capacity building is crucial for the success of the engagement.

The project intends to improve the security system in schools and colleges and accelerate progress by ensuring proper resource planning so as to deliver a

quality environment for students worldwide. The project aims to create a "***Safe and secure atmosphere***" that not only ensures the safety of a student but also enhances the productivity of the institution.