IMPLEMENTATION PLAN

Overview
The Implementation Plan describes how the information system will be deployed, installed and transitioned into an operational system. The plan contains an overview of the system, a brief description of the major tasks involved in the implementation, the overall resources needed to support the implementation effort (such as hardware, software. facilities, materials, and personnel), and any site-specific implementation requirements. The plan is developed during the Design Phase and is updated during the Development Phase; the final version is provided in the Integration and Test Phase and is used for guidance during the Implementation Phase. The outline shows the structure of the Implementation Plan.

1 INTRODUCTION

This project aims to reduce energy wastage in universities, specifically in classrooms, by automating the lighting and ventilation processes. The smart classroom system, which is self-contained and equipped with sensors and cameras, collects data about the classroom environment to determine the optimal settings for the lighting and ventilation systems. The system then automatically adjusts these settings to conserve energy, lower costs, and improve the classroom's comfort. Its most beneficial feature is its ability to save energy by adjusting the lighting and ventilation settings according to the number of people present in the classroom. This ensures that energy is not wasted when the classroom is vacant or has fewer occupants than usual. For instance, if the classroom is empty, the system will turn off the lights and ventilation, thereby conserving energy and reducing expenses. If there are a few people in the classroom, the system will adjust the settings to create a comfortable environment. Additionally, if the classroom is full, the system will increase the lighting and ventilation settings to ensure that everyone is comfortable.

1.1 Purpose

The purpose of this implementation plan is to outline the steps that will be taken to implement the Smart Classroom System. The system will use a combination of hardware and software to reduce energy consumption in classrooms.

The implementation plan will outline the following steps:

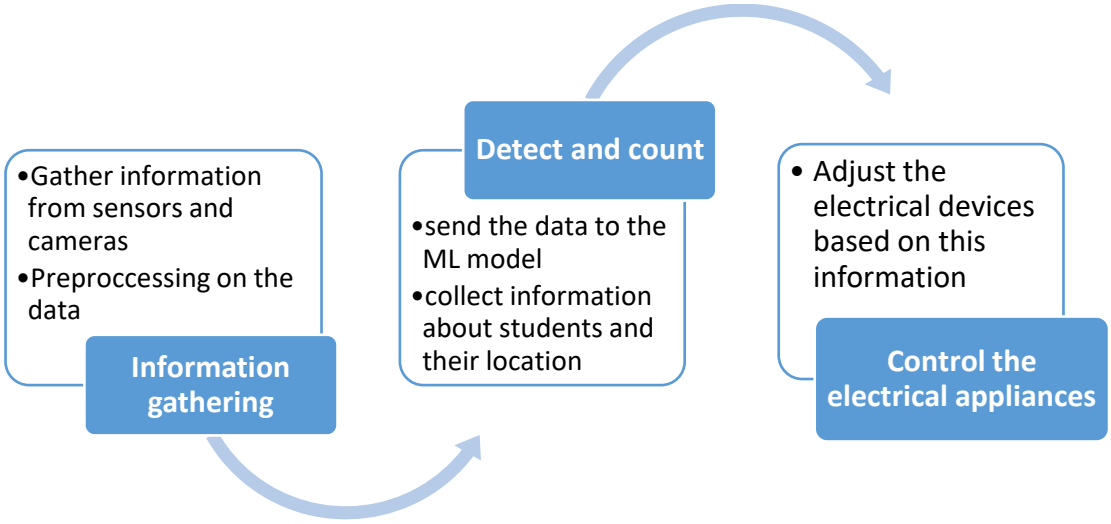
- Hardware and software development.
- Testing and deployment.
- Scalability testing and deployment.

The Smart Classroom System is an innovative solution that can aid universities in reducing energy consumption and cutting costs. The system's automated features, including light and air conditioning control based on the number of occupants and room temperature, will help optimize energy usage. Additionally, the system has the ability to count the number of people in a specific section of the classroom, which can be used to regulate lighting in that area.

1.2 System Overview

The smart classroom system is a new product that manages electrical devices in the classroom by collecting and processing data from sensors and cameras to control the lighting, air conditioning, and more. The system aims to increase efficiency and reduce energy waste.

As previously mentioned, this system works to reduce energy consumption through various processes. This will be achieved through some of its features, such as automatic operation. The system will automatically turn on and off at the scheduled start and end times of lectures each week, without requiring human intervention.
Organization of the system which is as follows.
• A camera will be used to take photos of the students in the classroom to determine their position, the camera should be placed in an appropriate location to take pictures of the classroom with a good angle.
• Various sensors will also be used to determine the temperature of the classroom, these sensors will be placed all around the classroom to accurately calculate the temperature.
• The GPIO pins in the RPI will be used to connect the electrical devices with the microprocessor and control them based on collected information from the camera and the sensors.



1.2.1 System Description

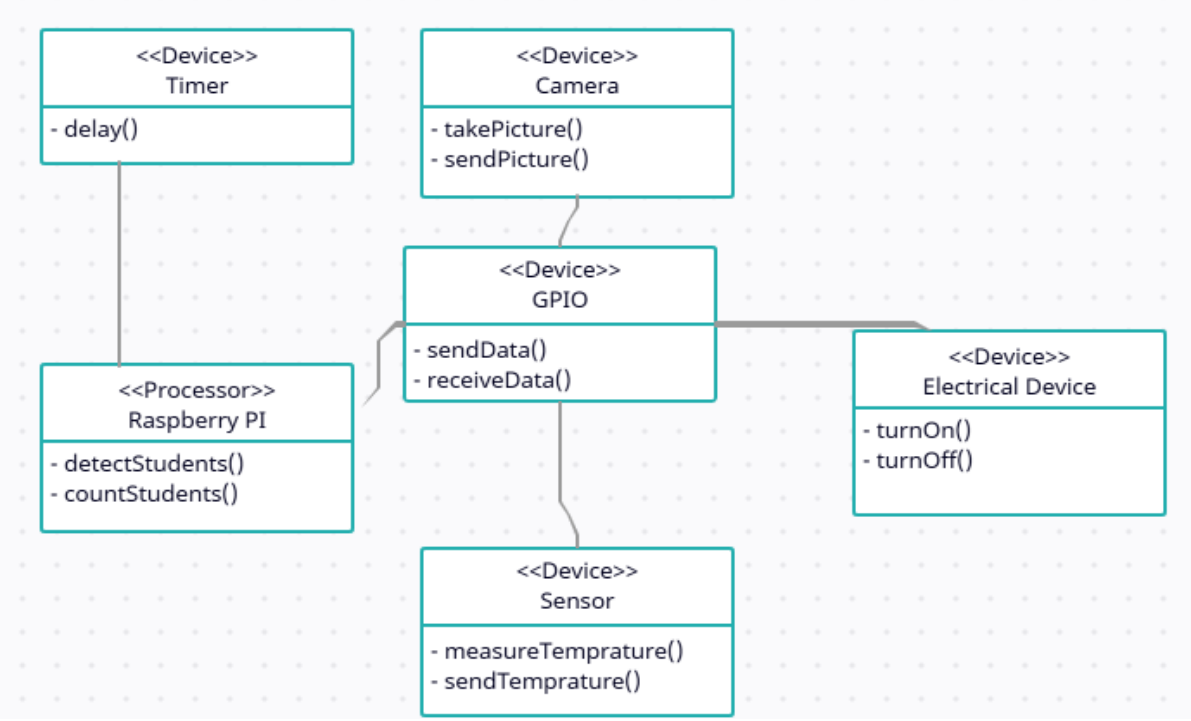
1. Study schedule based on it, the system will operate automatically at the start of each lecture and stop at its end, achieving the desired goal of the system, which is to conserve energy.
2. Count the number of people in a specific section of the classroom.
3. Control the lighting in a specific space based on the number of people in that space and turn it off when not in use.
4. Control air conditioners in a specific place based on the temperature and the number of people present in that place and shut them down when not in use.

1.2.2 System Organization

The system contains many components, whether hardware or software, and each component plays an active role in the system's operation with high accuracy. These components include measuring temperature and humidity, capturing images to determine the number of students, and components that include information about the study schedule to operate the system automatically.

Hardware:
1. Heat sensors
2. Camera
3. RPI microprocessor

Software:
1. SQLite Database Browser
2. Raspbian Operating system



1.3 Project References

This section provides a bibliography of key project references and deliverables that have been produced before this point in the project development.

1.4 Glossary

RPI	*raspberry PI*
ML	*Machine Learning*
GPIO	*General purpose input output*

2 MANAGEMENT OVERVIEW

The major tasks involved in the implementation of the Smart Classroom System are:

• Hardware and software development: This involves designing and building the hardware components of the system, as well as developing the software that will control the system.

• Testing and deployment: Once the hardware and software have been developed, they need to be tested to ensure that they are working properly. The system will then be deployed in a classroom setting to test its effectiveness in reducing energy consumption.

• Scalability testing and deployment: Once the system has been tested in a single classroom, it needs to be tested to ensure that it can be scaled up to work in multiple classrooms. The system will then be deployed in multiple classrooms to test its effectiveness in reducing energy consumption across an entire university.

2.1 Description of Implementation

The Smart Classroom System will be implemented in the following phases:

1. Hardware and software development: The first phase will involve the development of the hardware and software components of the system. This will include the design and construction of the camera, sensors, and Raspberry Pi microprocessor. The software for the system will be developed using Microsoft SQL Server Management Studio Express 2010 and Raspbian Operating system.
2. Testing and deployment: The second phase will involve testing the system and deploying it in a pilot classroom. This will allow the system to be tested in a real-world environment and any bugs or issues to be identified and addressed.
3. Scalability testing and deployment: The third phase will involve testing the system for scalability and deploying it in multiple classrooms. This will allow the system to be tested in a larger environment and ensure that it can be scaled to meet the needs of the university. The system will be deployed in a phased approach, starting with a few classrooms and then expanding to more classrooms as the system is proven to be effective. The system will be monitored and evaluated on an ongoing basis to ensure that it is meeting the project goals.

The following are some of the key considerations for the implementation of the Smart Classroom System:

• The system will need to be installed in a central location in the classroom, such as on the ceiling or wall.
• The camera will need to be positioned in a way that it can capture a clear view of the entire classroom.
• The sensors will need to be placed in strategic locations around the classroom to accurately measure the temperature.
• The Raspberry Pi microprocessor will need to be connected to the electrical devices in the classroom.
• The software for the system will need to be installed on the Raspberry Pi microprocessor.

2.2 Points of Contact

In this section, identify the System Proponent, the name of the responsible organization(s), and titles and telephone numbers of the staff who serve as points of contact for the system implementation. These points of contact could include the Project Manager. Program Manager, Security Manager. Database Administrator, Configuration Management Manager, or other managers with responsibilities relating to the system implementation. The site implementation representative for each field installation or implementation site should also he included, if appropriate. List all managers and staff with whom the implementation must be coordinated.

2.3 Major Tasks

Task	What the task will accomplish	Resources required	Key person(s)
Providing overall planning and coordination for the implementation	Ensure that all aspects of the implementation are well-planned and coordinated	Project manager, system engineer, electrical engineer	All tasks are completed on time and within budget.
Providing appropriate training for personnel	Ensure that all personnel who will be using the system are properly trained	Training manager, system engineer	All personnel are able to use the system effectively.
Ensuring that all manuals applicable to the implementation effort are available when needed	Ensure that all manuals and documentation are available to personnel who need them	Documentation manager, system engineer	All manuals and documentation are available when needed.
Providing all needed technical assistance	Ensure that all personnel who need technical assistance can get it	Technical support engineer, system engineer	All personnel who need technical assistance can get it in a timely manner.
Scheduling any special computer processing required for the implementation	Ensure that all special computer processing is scheduled and completed on time	System engineer, IT manager	All special computer processing is completed on time and within budget.
Performing site surveys before implementation	Ensure that the site is ready for implementation	Project manager, electrical engineer	The site is ready for implementation and all necessary changes have been made.
Ensuring that all prerequisites have been fulfilled before the implementation date	Ensure that all prerequisites for implementation have been met	Project manager, system engineer	All prerequisites have been met and the implementation can proceed on schedule.
Providing personnel for the implementation team	Ensure that there are enough personnel available to complete the implementation on time	Project manager, system engineer	There are enough personnel available to complete the implementation on time.

Acquiring special hardware or software	Ensure that all necessary hardware and software is acquired and installed	Project manager, system engineer	All necessary hardware and software is acquired and installed.
Performing data conversion before loading data into the system	Ensure that all data is converted into a format that can be used by the system	Data conversion specialist, system engineer	All data is converted into a format that can be used by the system
Preparing site facilities for implementation	Ensure that the site is ready for the installation of the system	Project manager, electrical engineer	The site is ready for the installation of the system and all necessary changes have been made.

2.4 Implementation Schedule

Task	Beginning Date	End Date
Providing overall planning and coordination for the implementation	2023-02-01	2023-02-15
Providing appropriate training for personnel	2023-02-16	2023-03-01
Ensuring that all manuals applicable to the implementation effort are available when needed	2023-03-02	2023-03-15
Providing all needed technical assistance	2023-03-16	2023-04-01
Scheduling any special computer processing required for the implementation	2023-04-02	2023-04-15
Performing site surveys before implementation	2023-04-16	2023-05-01
Ensuring that all prerequisites have been fulfilled before the implementation date	2023-05-02	2023-05-15
Providing personnel for the implementation team	2023-05-16	2023-06-01
Acquiring special hardware or software	2023-06-02	2023-06-15
Performing data conversion before loading data into the system	2023-06-16	2023-06-23
Preparing site facilities for implementation	242023-06-24	2023-07-02

3 IMPLEMENTATION SUPPORT

The Smart Classroom System requires a variety of software, materials, equipment, facilities, and personnel to be implemented. The specific requirements may vary depending on the specific needs of the university.

- Software: SQLite Database Browser and Raspbian Operating system
- Hardware: Heat sensors, Camera, RPI microprocessor, Laptop and Screwdriver
- Materials: Wiring, Cables and Power supply
- Facilities: Classroom and Electrical outlets

3.1 Hardware, Software, Facilities, and Materials

- Software: The system will require the following software:
  1. SQLite Database Browser
  2. Raspbian Operating system

- Hardware: The system will require the following hardware:
  1. Heat sensors
  2. Camera
  3. RPI microprocessor
  4. Laptop
  5. Screwdriver

- Materials: The system will require the following materials:
  1. Wiring
  2. Cables
  3. Power supply

- Facilities: The system will require the following facilities:
  1. Classroom
  2. Electrical outlets

3.1.1 Hardware

- Heat sensors: These sensors are used to measure the temperature of the classroom.
- Camera: This is used to count the number of people in the classroom.
- RPI microprocessor: This is the brains of the system. It collects data from the sensors, processes it, and sends commands to the electrical devices.
- Laptop: This is used to configure and manage the system.
- Screwdriver: This is used to install the hardware components of the system.
- Wiring and Cables: This is used to connect the hardware components of the system.
- Power supply: This is used to power the system.

• Classroom: This is where the system will be installed and used.

• Electrical outlets: This is where the system will be plugged in.

3.1.2 Software

• SQLite Database Browser: This software is used to view and manage the database that stores the data collected by the system.

• Raspbian Operating system: This is the operating system that runs on the RPI microprocessor.

3.1.3 Facilities

• Classroom for assembling and testing hardware components: This Classroom should be large enough to accommodate the assembly and testing of the hardware components of the system. It should also be well-lit and have access to power, this will be done for 4 hours per day, 5 days per week, for 2 weeks.

• Desk space for software installers: This desk space should be in a central location and should be large enough to accommodate the installation of the software components of the system. It should also have access to a computer with internet access, this will be done for 2 hours per day, 5 days per week, for 2 weeks.

• Classroom space for training the implementation staff: This classroom space should be large enough to accommodate the training of the implementation staff. It should also have access to a projector and a whiteboard, this will be done for 8 hours per day, 5 days per week, for 1 week.

3.1.4 Material

• Magnetic tapes: These tapes are used to store the data collected by the system. They are a reliable and cost-effective way to store large amounts of data.

• Disk packs: These disks are also used to store the data collected by the system. They are more expensive than magnetic tapes, but they offer faster access to data.

• Other materials: The system may also require other materials, such as cables, connectors, and mounting hardware. The specific materials required will vary depending on the specific configuration of the system.

3.2 Personnel

This section describes personnel requirements and any known or proposed staffing requirements, if appropriate. Also describe the training, if any, to be provided for the implementation staff.

3.2.1 Personnel Requirements and Staffing

In this section, describe the number of personnel, length of time needed, types of skills, and skill levels for the staff required during the implementation period. If particular staff members have been selected or proposed for the implementation, identify them and their roles in the implementation.

3.2.2 Training of Implementation Staff

This section addresses the training, if any, necessary to prepare staff for implementing and maintaining the system; it does not address user training, which is the subject of the Training Plan. Describe the type and amount of training required for each of the following areas, if appropriate, for the system:

- System hardware/software installation
- System support
- System maintenance and modification

Present a training curriculum listing the courses that will be provided, a course sequence. and a proposed schedule. If appropriate, identify which courses particular types of staff should attend by job position description.

If training will be provided by one or more commercial vendors, identify them, the course name(s), and a brief description of the course content.

If the training will be provided by State staff, provide the course name(s) and an outline of the content of each course. Identify the resources, support materials, and proposed instructors required to teach the course(s).

3.3 Performance Monitoring

This section describes the performance monitoring tool and techniques and how it will be used to help decide if the implementation is successful.

3.4 Configuration Management Interface

This section describes the interactions required with the Configuration Management (CM) representative on CM-related issues, such as when software listings will be distributed, and how to confirm that libraries have been moved from the development to the production environment.

4 IMPLEMENTATION REQUIREMENTS BY SITE

This section describes specific implementation requirements and procedures. If these requirements and procedures differ by site, repeat these subsections for each site; if they are

the same for each site, or if there is only one implementation site, use these subsections only once. The "X" in the subsection number should be replaced with a sequenced number beginning with I. Each subsection with the same value of "X" is associated with the same implementation site. If a complete set of subsections will be associated with each implementation site, then "X" is assigned a new value for each site.

4.1 Site Name or identification for Site X

This section provides the name of the specific site or sites to be discussed in the subsequent sections.

4.1.1 Site Requirements

This section defines the requirements that must he met for the orderly implementation of the system and describes the hardware, software, and site-specific facilities requirements for this area.

Any site requirements that do not fall into the following three categories and were not described in Section 3, Implementation Support, may be described in this section, or other subsections may be added following Facilities Requirements below:

- Hardware Requirements - Describe the site-specific hardware requirements necessary to support the implementation (such as. LAN hardware for a client/server database designed to run on a LAN).

- Software Requirements - Describe any software required to implement the system (such as, software specifically designed for automating the installation process).

- Data Requirements - Describe specific data preparation requirements and data that must be available for the system implementation. An example would be the assignment of individual IDs associated with data preparation.

- Facilities Requirements - Describe the site-specific physical facilities and accommodations required during the system implementation period. Some examples of this type of information are provided in Section *3*.

4.1.2 Site implementation Details

This section addresses the specifics of the implementation for this site. Include a description of the implementation team, schedule, procedures, and database and data updates. This section should also provide information on the following:

- Team--If an implementation team is required, describe its composition and the tasks to be performed at this site by each team member.

- Schedule--Provide a schedule of activities, including planning and preparation, to be accomplished during implementation at this site. Describe the required tasks in chronological order with the beginning and end dates of each task. If appropriate, charts and graphics may be used to present the schedule.

- Procedures--Provide a sequence of detailed procedures required to accomplish the specific hardware and software implementation at this site. If necessary, other documents may be referenced. If appropriate, include a step-by-step sequence of the detailed procedures. A checklist of the installation events may he provided to record the results of the process.

If the site operations startup is an important factor in the implementation, then address startup procedures in some detail. If the system will replace an already operating system, then address the startup and cutover processes in detail. If there is a period of parallel operations with an existing system, address the startup procedures that include technical and operations support during the parallel cycle and the consistency of data within the databases of the two systems.

- Database--Describe the database environment where the software system and the database(s), if any, will be installed. Include a description of the different types of database and library environments (such as, production, test, and training databases).

- Include the host computer database operating procedures, database file and library naming conventions, database system generation parameters, and any other information needed to effectively establish the system database environment.
- Include database administration procedures for testing changes, if any, to the database management system before the system implementation.

- Data Update--If data update procedures are described in another document, such as the operations manual or conversion plan, that document may be referenced here. The following are examples of information to be included:

    - Control inputs
    - Operating instructions
    - Database data sources and inputs
    - Output reports
    - Restart and recovery procedures

4.1.3 Back-Off Plan

This section specifies when to make the go/no go decision and the factors to be included in making the decision. The plan then goes on to provide a detailed list of steps and actions required to restore the site to the original, pre-conversion condition,

4.1.4 Post-Implementation Verification

This section describes the process for reviewing the implementation and deciding if it was successful. It describes how an action item list will be created to rectify any noted discrepancies. It also references the Back-Off Plan for instructions on how to back-out the installation, if, as a result of the post-implementation verification, a no-go decision is made.