DESIGN AND FABRICATION OF AN IOT MONITORING AND CONTROLLING SYSTEM FOR GREENHOUSE APPLICATION.

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STUDENT DETAILS:

NAME	YEAR	SIN	PROGRAM
PRAISE MWANZA	5TH	19138292	MECHATRONICS

CONTENT

INTRODUCTION

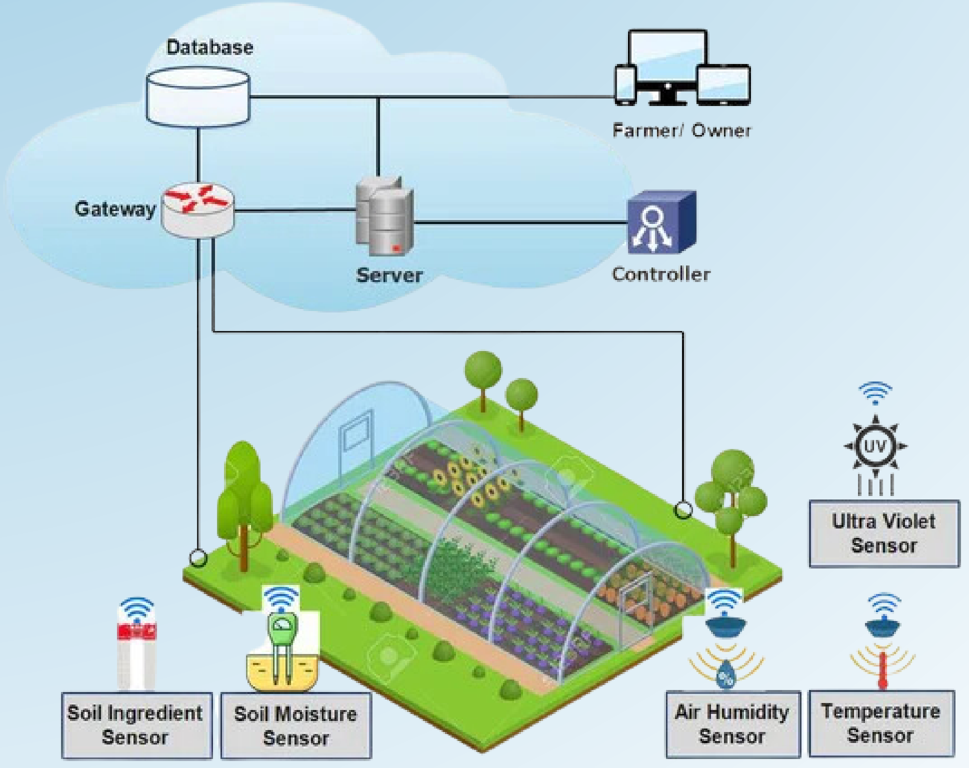


Figure 1. An illustration of IoT application for monitoring farming conditions in a greenhouse.

- The agriculture sector provides a livelihood to more than 70 percent of Zambia's population. In terms of performance, in the ten-year period between 2011 and 2020, agricultural growth averaged 0.4 percent while its share of GDP was 5.8 percent.

- Parameters like temperature, humidity, and moisture crucial for greenhouse environments, can be efficiently managed through IoT frameworks.
- IoT enables efficient monitoring and cultivation.
- Systems facilitate seamless data transfer

PROBLEM STATEMENT

Certain crops like vanilla orchids and saffron, crucial for biscuit, bread, and cake production, cannot be cultivated locally due to our harsh environment. Consequently, we heavily rely on imports for these ingredients, exacerbating our trade deficit and weakening our currency.

This reliance on imports not only increases the cost of living but also leaves us vulnerable to fluctuations in global market prices. Additionally, importing essential ingredients for food production undermines our food security and economic independence.

Figure 2. An illustration of manual vanilla greenhouse monitoring.

MOTIVATION

Figure 3. An illustration of an automated greenhouse

Using IoT technology, the project aims to replicate the native tropical environmental conditions required for the cultivation of foreign crops like vanilla orchids and saffron.

This will enable local production of these crops, reducing reliance on imports and enhancing agricultural sustainability.

AIM

The project aims to design and fabricate an IoT monitoring and controlling system for greenhouse application.

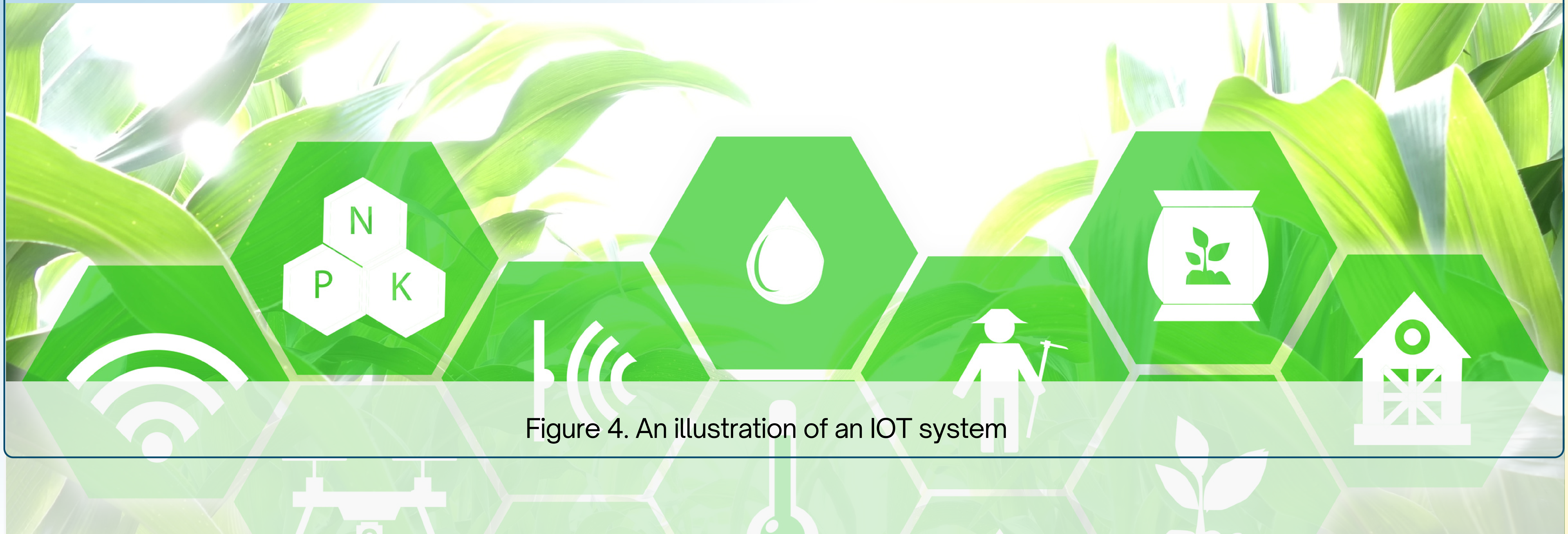


Figure 4. An illustration of an IOT system

OBJECTIVES

1 To design a robust and scalable architecture for the IoT-based greenhouse monitoring and controlling system.

Figure 5. An illustration of objectives

2 To select and integrate appropriate sensors and actuators to measure environmental parameters and control greenhouse components, called the Greenhouse care Box.

3 To integrate communication protocols and interfaces for seamless data exchange between sensors, actuators and the central IoT platform.

4 To design a user-friendly mobile app for remote monitoring, control, and management of the greenhouse system, called the Greenhouse Care App.

PROJECT SCOPE

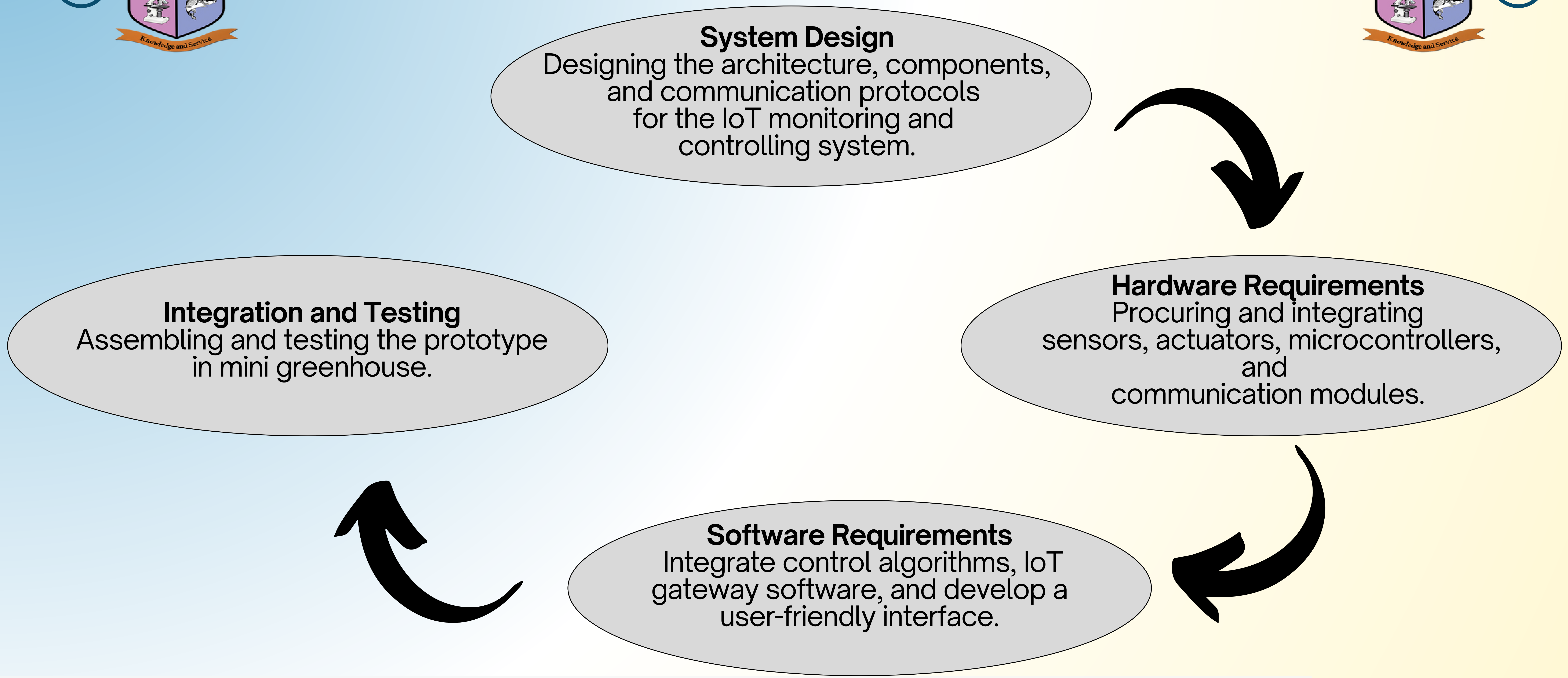


Figure 6. An illustration of the project scope

LITERITURE REVIEW

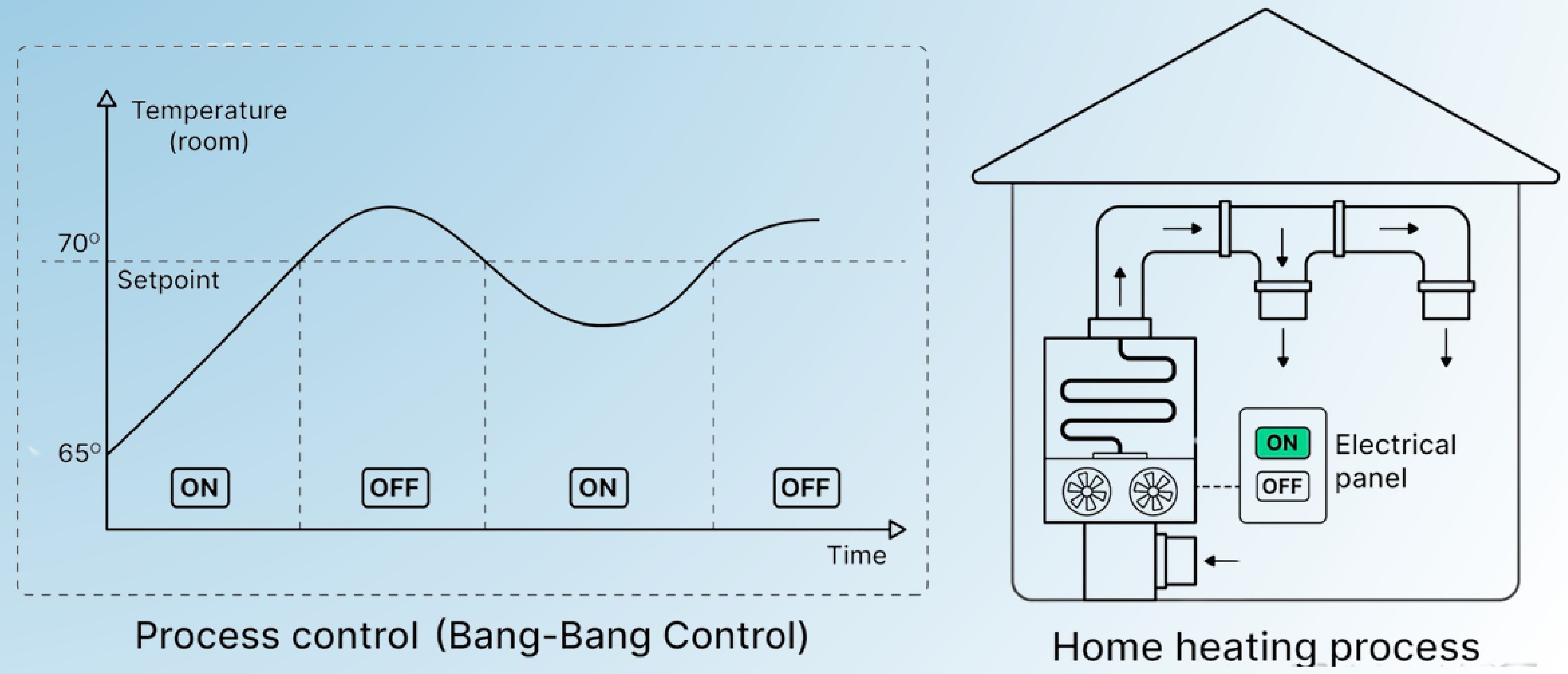


Figure 8. Bang-Bang Control

Bang-bang control can lead to overshooting of the desired setpoint, as it operates in an on-off manner without proportional adjustment. This can result in instability or oscillations in the controlled system.

Title: IoT-based Smart Agriculture: Towards Making the Fields Talk

- Authors: Gubbi, Jayavardhana; Buyya, Rajkumar; Marusic, Slaven; Palaniswami, Marimuthu

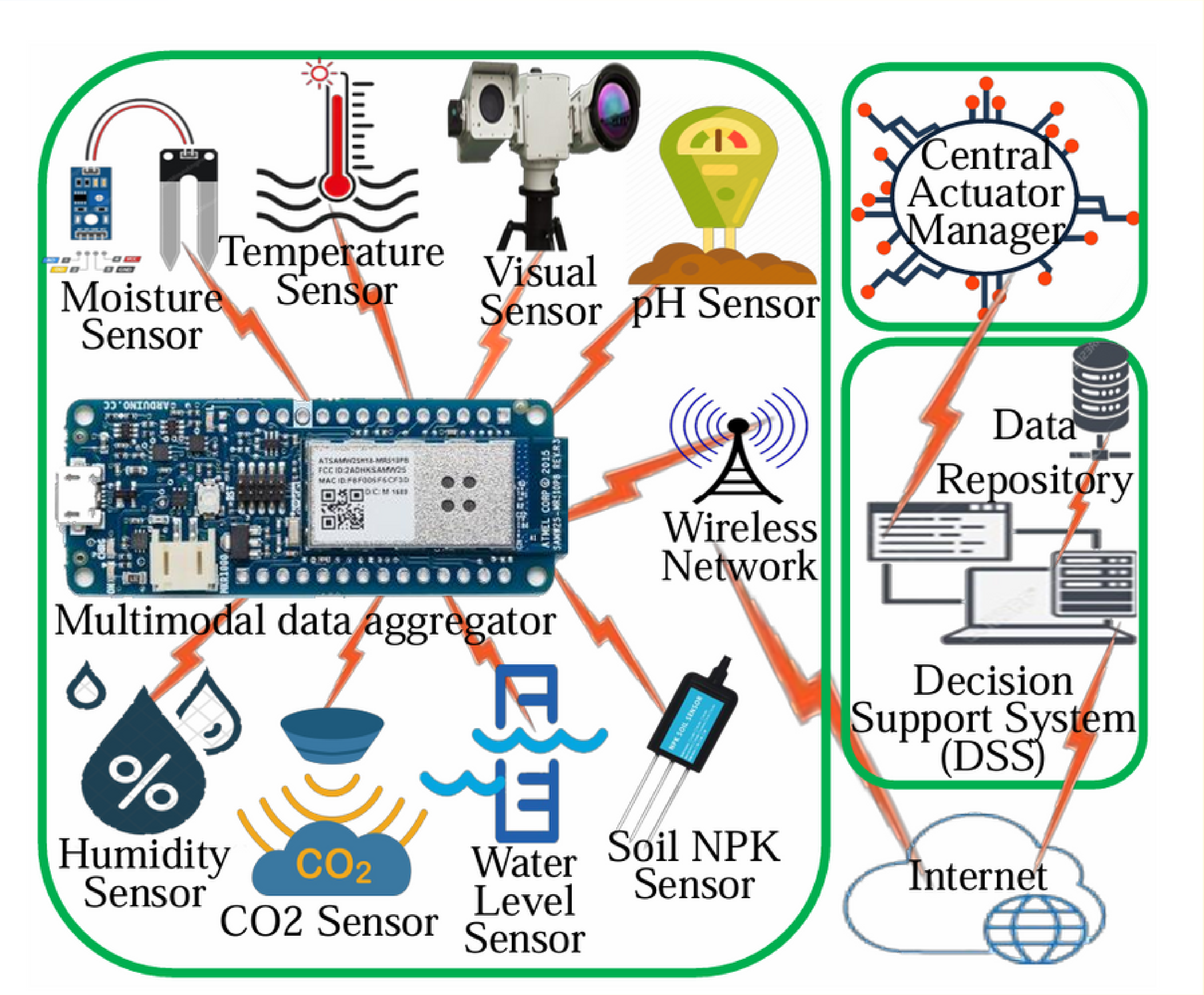


Figure 7. Data acquisition system (DAS) for rose farming monitoring. Done by Pradyumna K. Tripathy Silicon Institute of Technology in India.

LITERITURE REVIEW...CONT.

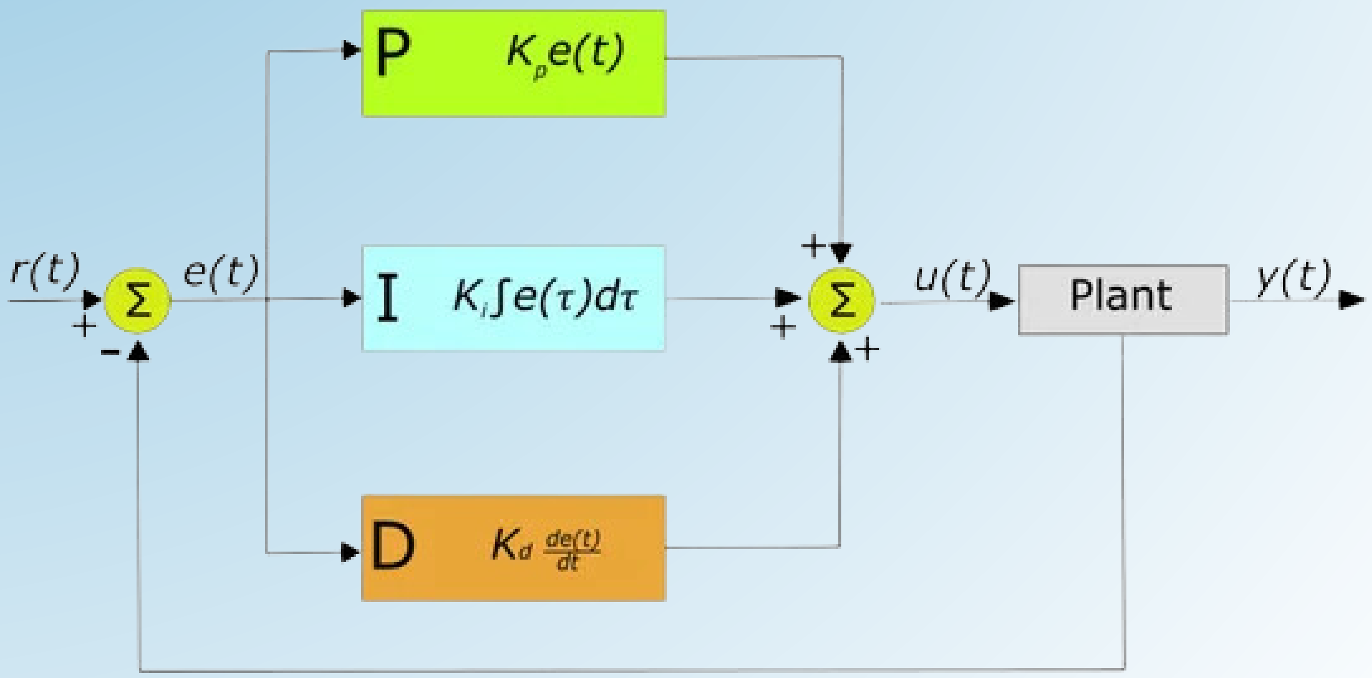


Figure 9. PID controller design

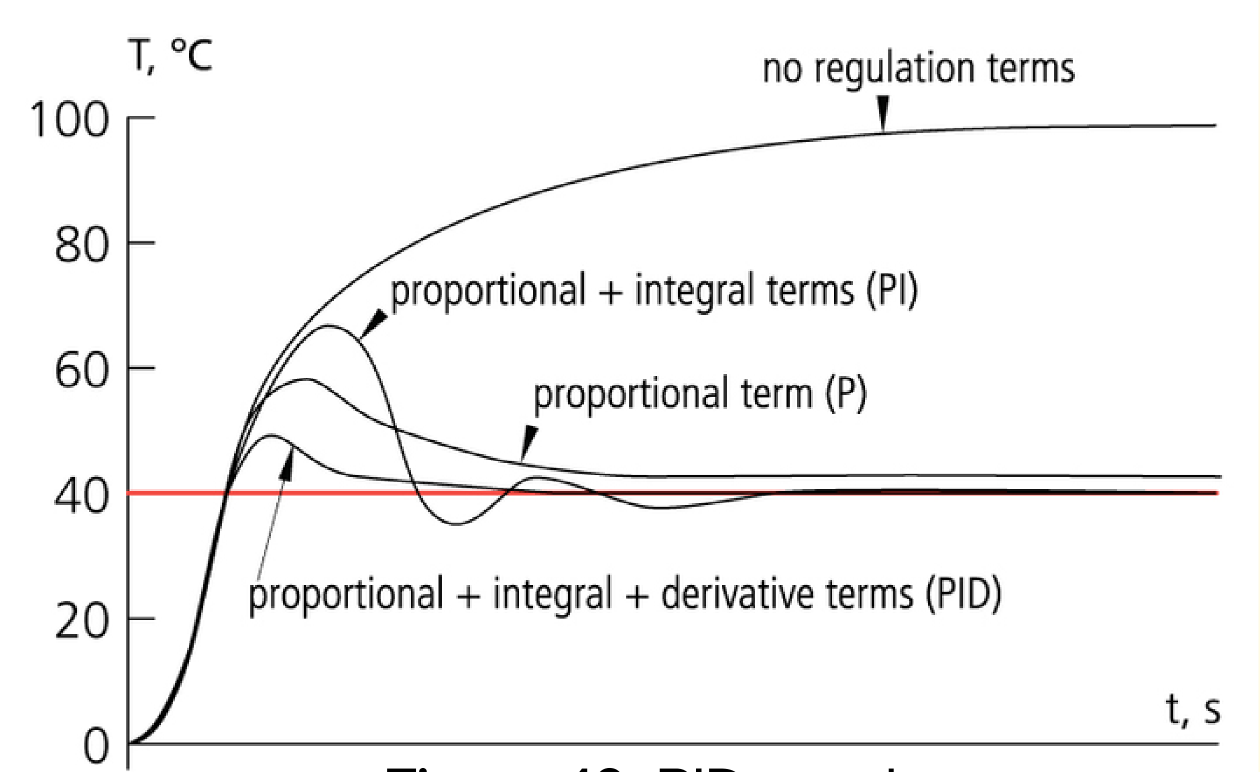


Figure 10. PID graph

The control parameters must be adjusted to improve system performance. Stability is a base requirement, but different values of the gains may lead to different settling times, overshooting, etc. For this reason, PID tuning can be a difficult process.

1. Proportional (P): Adjusts output based on current error.
2. Integral (I): Integrates past errors to minimize steady-state offset.
3. Derivative (D): Considers error rate for anticipatory control.

METHODOLOGY

1. **System Design**:

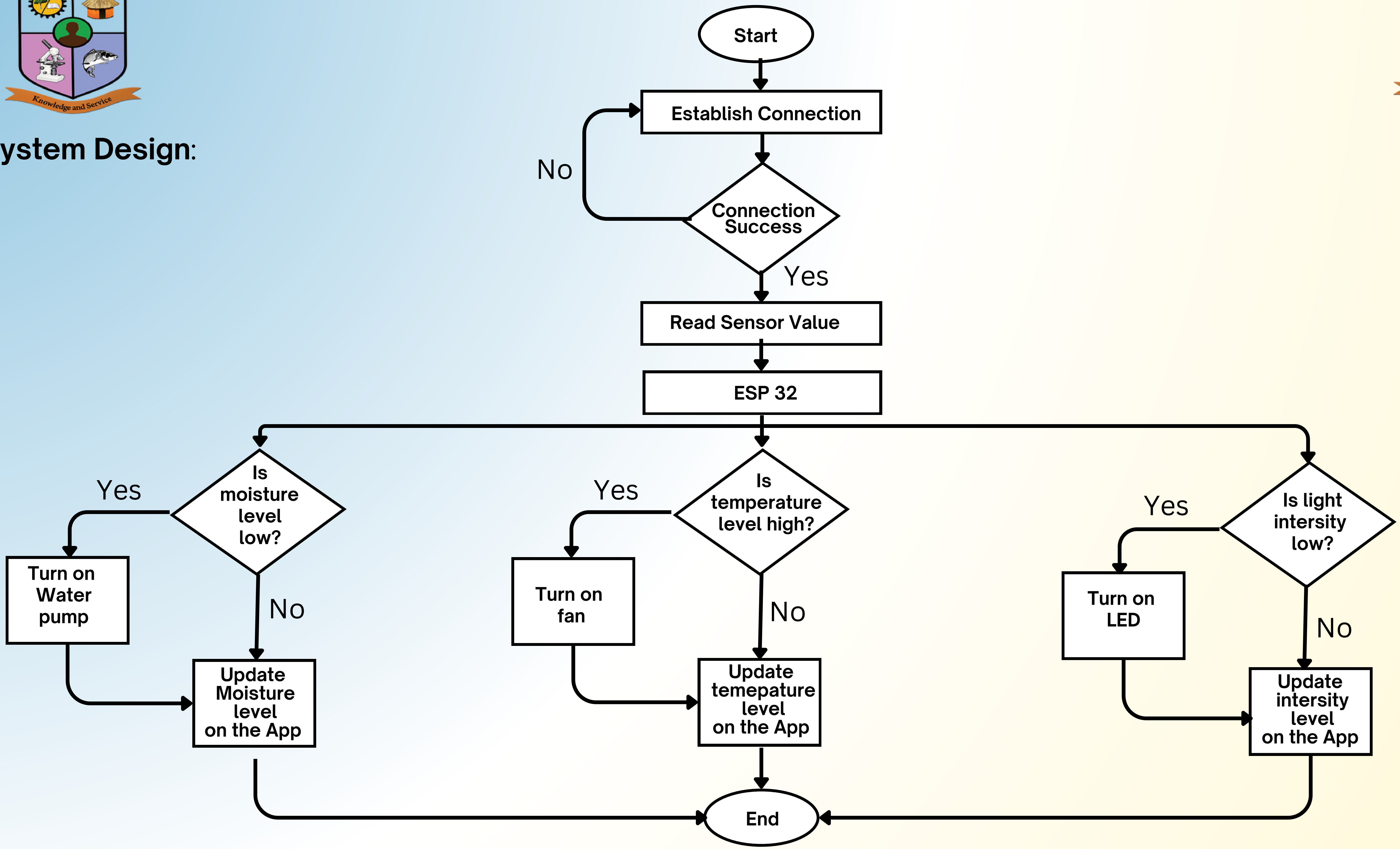


Figure 6. Flowchart of the System

METHODOLOGY...CONT.

2. Hardward Design:

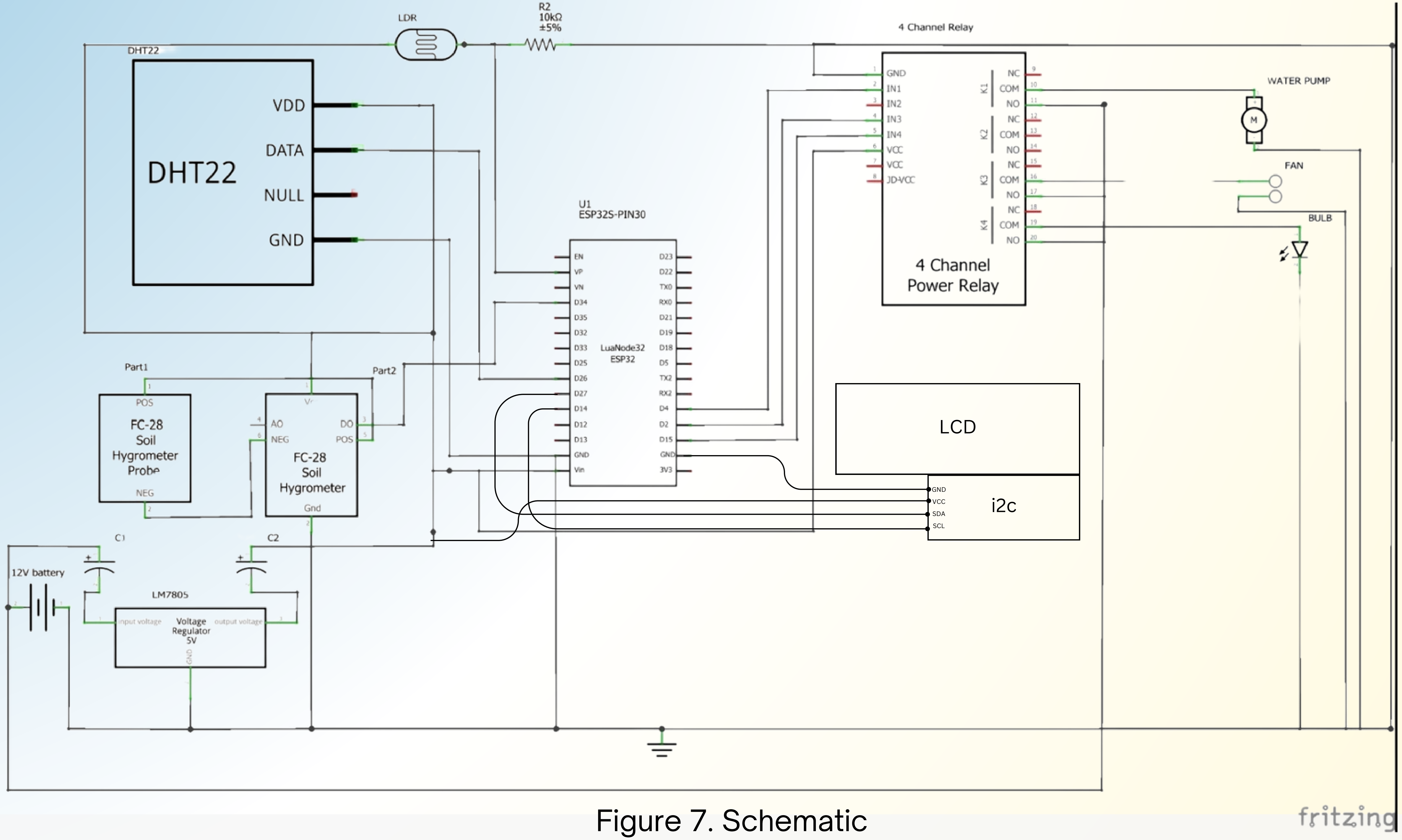


Figure 7. Schematic

METHODOLOGY...CONT.

3. Software design:

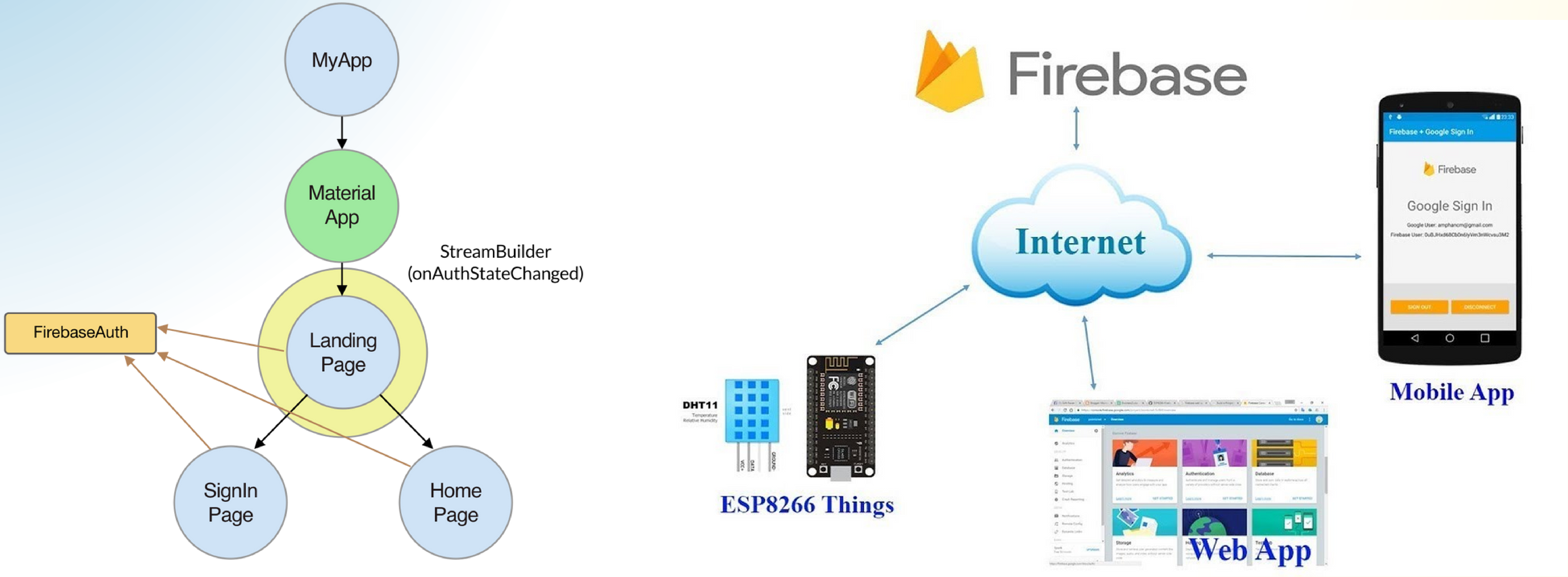


Figure 8. Software frame wrok

PROJECT PLAN-GANTT CHART

System Design: Define system requirements Design system architecture & Select components Design communication protocols.

Hardware Requirements: Research and select appropriate sensors, actuators, microcontrollers, Procure hardware component.

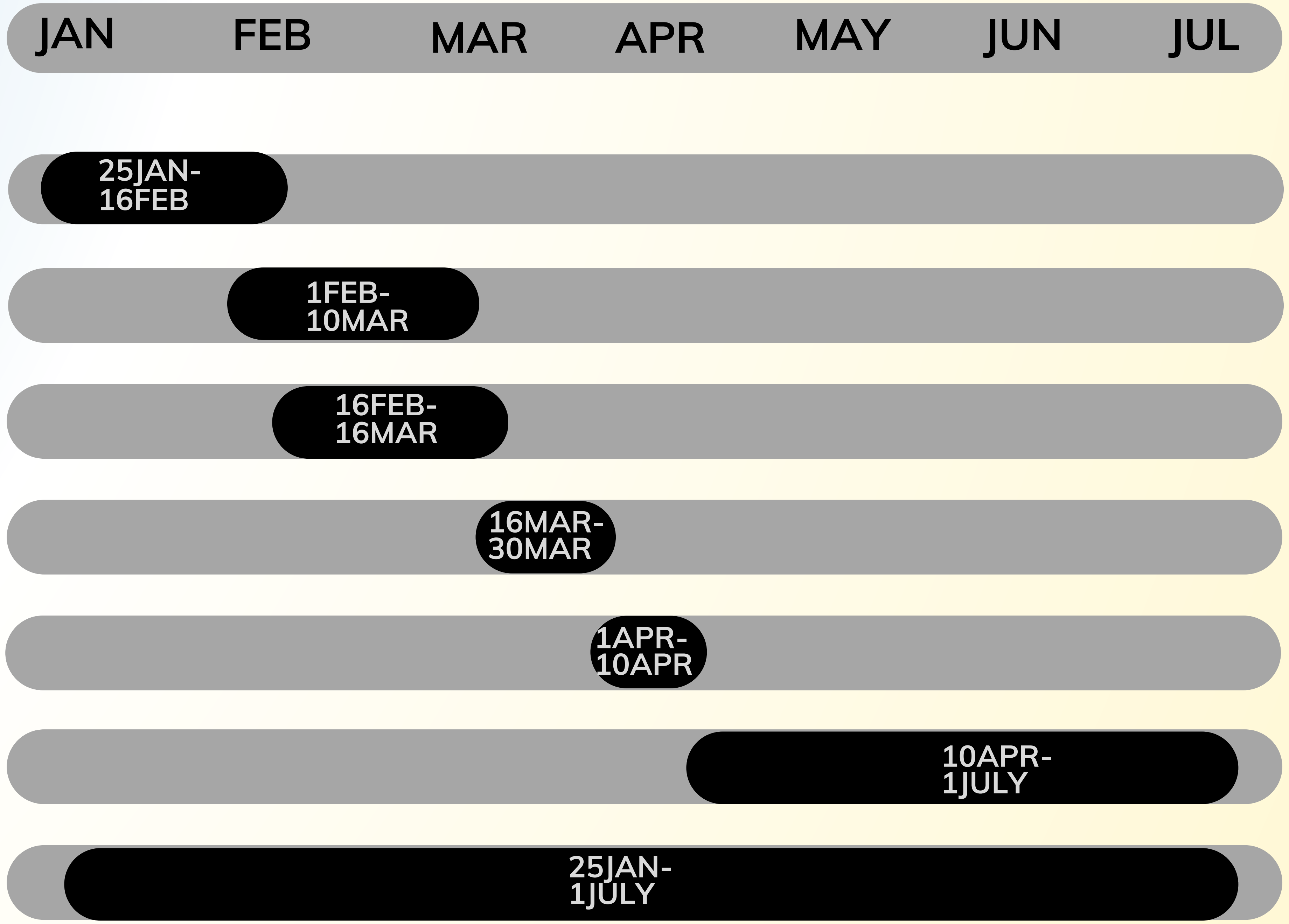
Software Requirements: Develop IoT gateway software, Design user-friendly interface for remote monitoring and control

Hardware Requirement t: Integrate hardware components Test hardware functionality

Software Development: Implement control algorithms

Integration and Testing: Assemble hardware components, Integrate software components with hardware, Conduct initial testing

Documentation: Document system design, architecture specifications, integration process software development process and literiture review



BUDGET

S/N	COMPONENTS	SPECIFICATIONS	UNIT PRICE	LINE TOTAL
1	ESP 32	32 bit,4MB flsh,240MHz, 30pin	k450	k450
2	Relay	Supply voltage: 3.75V to 6V DC	k380	k380
3	LCD + i2c	4x20 display	k300	k300
4	LED strip	12v dc,input 220-240v	k50	k50
5	Capacitor & Resistors	1 ceramic capacitor and 2 electrolytic capacitors & 10 kilo ohms	k10	k30
7	LDR	10 kilo ohms	K20	K20
8	DHT22 temperature sensor	Operating voltage: 3.3-5.5V DC Operating range: humidity 0-100%RH temperature - 40 80Celsius	k150	k150
9	Soil moisture + probe	Operating power: 3mA @ 5VDC Operating temperature: - 400C to +600C	k200	k200
10	Voltage regulator,LM7085	Input voltage: 7 – 35V DC Output voltage: 5V DC Operating current: 5mA Output current: up to 1.5A	k40	k40
11	Fan	Rated voltage: DC 12V Current: 0.16A Speed (RPM): 3900 (±5%) Airflow (CFM): 5	k50	k50
12	Power supply	Input voltage: 100V – 240V AC AC input frequency: 50/60Hz Output voltage: 12V DC Output current: 2.5A Output power: 24W	k100	k100
13	HostIng	Microsoft Azure, Firebase	k300	k300
14	Mini-greenhouse	0.5m x 1.5m x 0.5m-Dimension-Testing environment	k300	k300

k2618+ 10% miscellaneous

k2380

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Knowledge and Service

THANK YOU

“ We’re here to put a dent in the universe.
Otherwise why else even be here?”