

# CAPSTONE PROJECT

## SMART CITY AUTOMATION - FROM ANIMATION TO REALITY

### Objective

Design and build a smart city automation system that integrates animation, robotics, and Python programming. Students will simulate traffic systems, smart lighting, and environmental monitoring using animation tools, coding structures, and IoT concepts to automate key city operations.

### Session 1: Creating Interactive Animations in Krita

#### Activities

##### 1. Animating Smart City Features in Krita

###### ◊ Task

- ✦ Students will use Krita to create animations for various smart city features, such as traffic lights and LED streetlights that adjust based on the time of day or environmental factors. They will use layers, animation timeline, and frame-by-frame animation to simulate these features.

###### ◊ Skills Practised

- ✦ Layer management to organize different parts of the animation (e.g., background, lights, objects)
- ✦ Using animation tools to create frame-by-frame animations for dynamic objects
- ✦ Timing and sequencing the movement of objects in the animation

##### 2. Creating Interactive Bouncing Ball Animation

###### ◊ Task

- ✦ Students will animate a bouncing ball using Krita, demonstrating basic animation principles. They will add motion blur effects and use layer management to control the ball's movement.

###### ◊ Skills Practised

- ✦ Creating keyframes for the ball's movements and adjusting the timing to show smooth animation



- ✦ Adding effects like motion blur to enhance the feeling of speed and movement
- ✦ Exporting the animation for use in a web environment or project

### Outcome for Session 1

- ✦ An animated smart traffic system created in Krita, including dynamic traffic lights and LED streetlights.
- ✦ An interactive bouncing ball animation demonstrating basic animation concepts and frame-by-frame movement.

## Session 2: Programming the Smart City with MakeCode Arcade and Python

### Activities

#### 1. Building Traffic Light System in MakeCode Arcade

##### ✦ Task

- ✦ Students will use MakeCode Arcade to design a traffic light system for the smart city, using control structures like loops and if-else statements to automate the switching of lights. They will program the traffic light to switch between red, yellow, and green based on time intervals.

##### ✦ Skills Practised

- ✦ Understanding control structures such as loops and if-else statements
- ✦ Using variables to store time intervals for traffic light changes
- ✦ Creating events for automatic traffic light transitions

#### 2. Automating the Smart City Traffic System with Python

##### ✦ Task

- ✦ Students will use Python to automate the control of the traffic lights based on real-time traffic data. The program will use loops to continuously monitor traffic and adjust the lights accordingly, ensuring smooth traffic flow.

##### ✦ Skills Practised

- ✦ Writing Python code using loops and functions to automate smart city features
- ✦ Reading inputs from sensors (simulated) to control the timing of traffic lights
- ✦ Using variables to track time and change traffic light states dynamically

### Outcome for Session 2

- ✦ A traffic light system designed using MakeCode Arcade, automating light transitions.
- ✦ A Python script that controls the traffic system based on real-time data.



## Session 3: Integration and Automation with AI and Robotics

### Activities

#### 1. Creating an Automated Streetlight System with AI

##### Task

- Students will design an AI-based system that controls streetlights based on environmental data such as ambient light levels (e.g., the streetlights turn on automatically at night). They will use basic AI algorithms to process data and trigger the streetlights accordingly.

##### Skills Practised

- Understanding the basics of AI and machine learning for real-time decision making
- Programming a decision-making system to control streetlights based on data inputs
- Integrating sensors (simulated) to collect data and control streetlight functionality

#### 2. Robotic Arm for Waste Collection in the Smart City

##### Task

- Students will simulate a robotic arm that collects waste in the smart city. The robotic arm will be controlled using Python, with automation features like pickup and drop-off actions. They will write Python functions to automate the robot's movements.

##### Skills Practised

- Writing Python functions to control robotic movements (e.g., pick and place)
- Using logic blocks in Python to automate actions based on events (e.g., waste collection triggers)
- Integrating IoT sensors for detecting waste or obstacles in the robot's path

### Outcome for Session 3

- An AI-based streetlight control system that adjusts lights based on real-time environmental data.
- A robotic arm simulation for waste collection, programmed using Python.

### Final Deliverables

Tick (✓) the box if submitted:

- Animated Smart City Features like traffic lights and streetlights are created using Krita.
- Traffic Light System Simulation designed in MakeCode Arcade and automated with Python.





◊ AI-based Streetlight System that reacts to environmental data.



◊ Robotic Arm Simulation for waste collection, programmed using Python.



◊ Final Presentation demonstrating the complete smart city simulation, integrating animation, control systems, and robotics.



This Capstone Project allows students to integrate animation, robotics, AI, and Python programming to simulate a smart city with automated traffic and waste management systems. The project combines creativity, coding, and real-time automation to build a smart and sustainable urban environment.

