Impact Analysis Tool

Smart Secure Entry System with Facial Recognition

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Project Overview

Project Title: Smart Secure Entry System with Facial Recognition
Description: An IoT-based access control system utilizing Raspberry Pi 5 edge computing, PIR motion sensors, and facial recognition to provide secure, contactless entry without relying on cloud storage.

1. Environmental Impact Analysis

Impact Category	Nature	Extent	Timing	Severity	Duration	Reversibility	Uncertainty	Sig.	
The Climate *Justification:* The system will be powered by low-voltage DC (Raspberry Pi 5). Although it consumes electricity, the carbon footprint is insignificant as compared to conventional server-based security systems. When it is on, the device has a low power consumption of about 4.8W, which reduces its impact on greenhouse gas emissions.									
Use of Energy *Rationalization:* Positive Effect. In particular, this project focuses on the energy efficiency by employing the Passive Infrared (PIR) sensor to activate the camera. This event-driven design saves 68% of energy used by continuous recording systems (1.2W idle vs. 4.8W active) and fosters energy conservation.									
Air Quality *Reasoning:* The system is an indoor system that does not emit any direct emissions, fumes or any particulate matter. It substitutes the usage of physical keys or plastic cards, possibly lowering the pollution in manufacturing of the disposable RFID plastic cards.									

Waste Production & Recycling *Reasoning:* The prototype consists of standard modular parts (Pi Camera v2, Servos, Jumpers) which can be reused in future laboratories in large amounts. The enclosure is the major possible source of waste, however, the electronic components have a long life and do not need to be disposed of regularly.
Sustainability *Justification:* The project will incorporate the concept of Edge Computing which conserves bandwidth and power used to send heavy video data to the cloud. By data processing in place, it lowers the total carbon footprint of data transmission and data storage on remote servers.

2. Economic Impact Analysis

Impact Category	Nature	Extent	Timing	Severity	Dura-tion	Re-versibil-ity	Uncer-tainty	Sig.
Economic Prosperity (Cost Effectiveness) *Reason:* This implementation is under AED 500 in terms of total hardware cost which is a far cheaper option as compared to commercial offerings which may cost more than AED. It offers the budget-friendly security option to small business owners and home users and liberates the capital to invest in other areas.								
Market Mechanisms *Justification:* The system uses off-the-shelf elements (Raspberry Pi, Servo SG90), which proves that high-security biometrics do not imply proprietary and costly hardware. This facilitates the open-market attitude to security and stimulates DIY solutions in housing industries.								
Innovation, Research and Development *Justification:* The project is novel as it integrates Tailscale VPN (Zero-trust networking) and local edge processing. It is a demonstration of conceptualization of long-lasting, remote-managed IoT equipment at no monthly cloud subscriptions, which encourages innovation in the ”Security-as-a-Service” market.								
Public Budgets or Services *Reason:* This technology will help save money on operational costs of a public building or university by eliminating entry officers or manual inspections campuses. It also enables security staff to concentrate on alert control and not necessarily protecting doors physically.								

3. Social Impact Analysis

Impact Category	Nature	Extent	Timing	Severity	Dura-tion	Re-versibil-ity	Uncer-tainty	Sig.
Health and Longevity *Justification:* This is a contactless system as indicated in the motivation of the report. In a post-pandemic environment, there needs to be a reduction in the number of physical touchpoints (keys, fingerprint scanners) reduce the chances of germ spread, which has a positive effect on the health of the population.								
Safety *Reasoning:* This system will enhance the physical security through biometric authentication (face) which cannot be stolen like a key or card. It also logs all attempts to enter (encrypted pictures), which offer forensic details in case of the attempt to break-in, which enhances the user security.								
Privacy and Personal Data *Justification:* Impact Critical. This project uses all the data locally in contrast to having face data uploaded to Amazon or Google databases like in a commercial system. the Raspberry Pi. This makes sure that user biometric information is never transferred outside of the local network and that user privacy is highly enforced as well as the protection of the user against cloud data breaches.								
Standard of Living *Rationale:* Keyless entry enhances the quality of life and convenience. Users do not have to fear that they would lose physical keys or forget the PIN codes. The fact that someone using the system can do so without hands is beneficial to users who have groceries or bags which facilitates almost everyday communication with their home space.								
Social Reasonability (Inclusion) *Rationale:* Facial recognition is a non-interactive authentication. It is very easy to use that could easily be used by individuals with motor disabilities who may find it difficult to turn operating a small keypad, thereby facilitating the accessibility of secured spaces to be inclusive.								