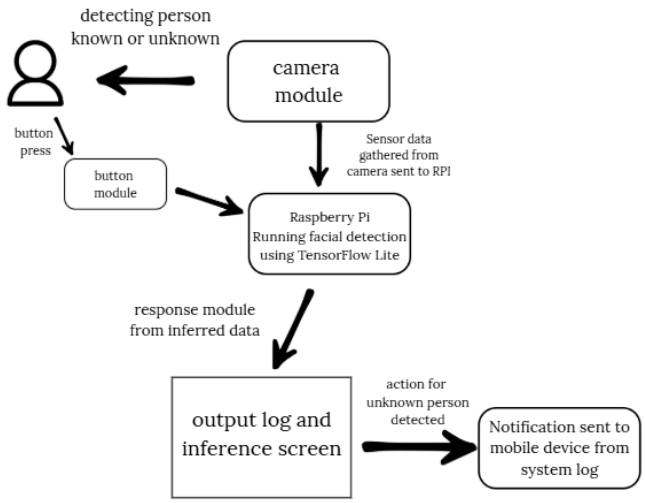
Divyesh Biswas, Gaurav Hareesh, Joe Paola
09/28/2025
ECE 535: Network Embedded System Design
Prof Fatima Anwar

Project Proposal

7. Smart Doorbell using Raspberry Pi and ML
   - Motivation:
     - Edge devices like Raspberry Pi are increasingly used for deploying ML systems in real-world settings. Because of this we want to gain experience training and deploying ML models on low level, resource constrained hardware. Creating a smart doorbell with people recognition gives us the opportunity to build a useful real world device while learning about ML deployment.
   - Design Goals:
     - Use Raspberry Pi with a camera module to design a smart doorbell that can detect people and classify whether they are recognized or unknown.
     - Learn how to deploy ML models on Raspberry Pi
   - Deliverables:
     - Implement a lightweight face detection or person detection model using TensorFlow Lite.
     - Build a simple system that, when someone appears at the door, captures an image and classify
     - Optional: Add an alert mechanism (e.g., send a notification to a phone or log it in a file)
   - Hardware/Software:
     - Needed Hardware:
       - Raspberry with its peripherals such as Power Supply, MicroSD card, Optional: Buzzer for local sound alerts and button for camera activation
       - Camera
     - Needed Software:
       - Google Colab
       - CNN based face recognition model
       - Python
       - Libraries such as Tensorflow, OpenCV for Image processing, NumPy
   - System Blocks



- Team member responsibilities
    - Research: Everyone
    - Model Training: Joe Paola
    - Hardware setup: Gaurav Hareesh
    - Software development: Everyone
    - Writing and Verification: Divyesh

- Timeline
    - Week 1-2: Research & Setup
        - Gain better understanding of what we need to do to implement the project and gather the materials needed to complete it
    - Week 2-4: Model Training & Optimization
        - Train the model to identify known people, convert to tensorflow format
    - Week 5-6: Hardware Integration & Programming
        - Put the model onto our system and implement/test the software
- References:
    - A lightweight CNN paper on edge vision (https://arxiv.org/abs/1704.04861).