

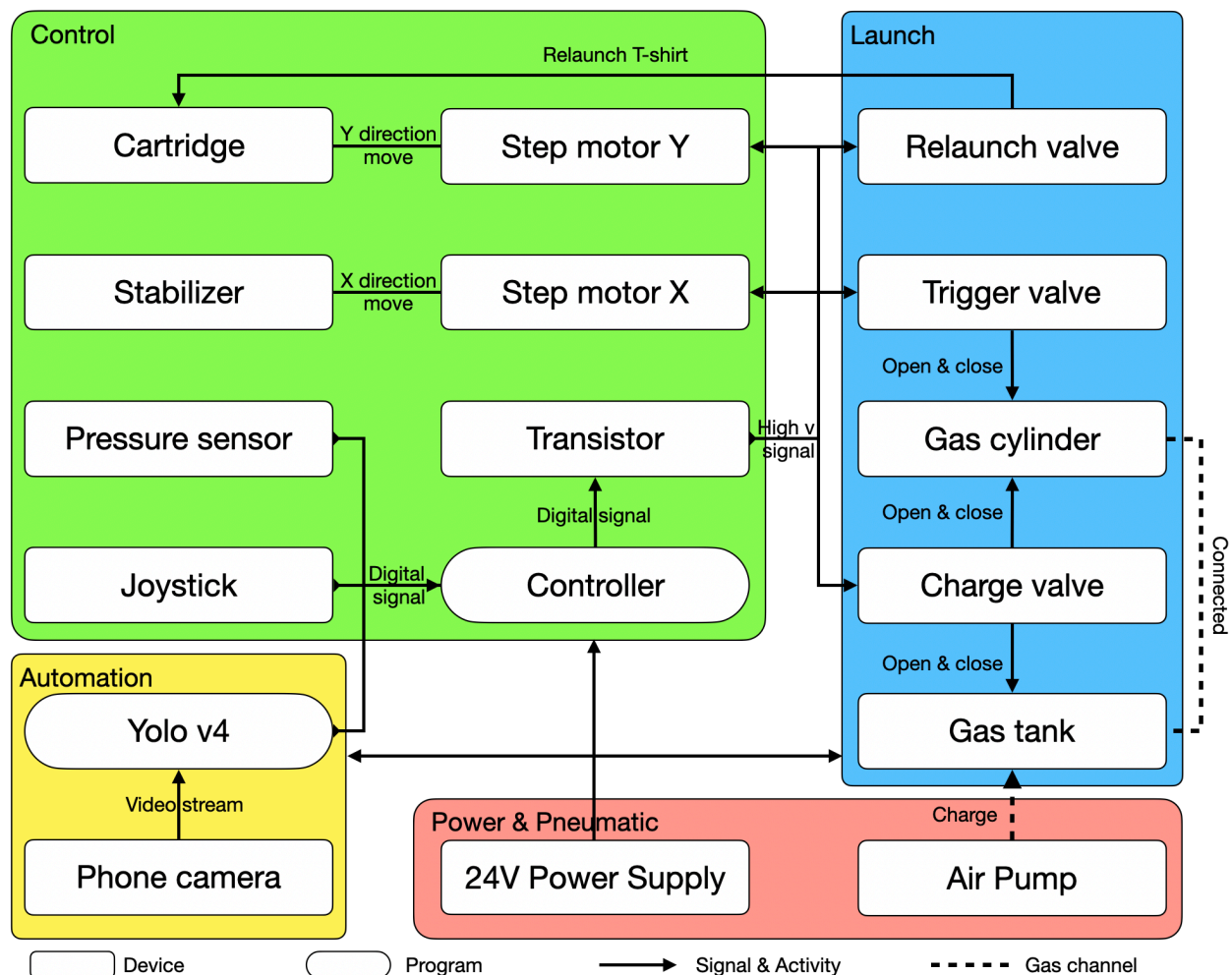
Robotic T-shirt Launching System Mark II

Introduction

The T-Shirt Launcher Mark II is an innovative device designed to efficiently fire packed T-shirts into crowds. Building upon the success of the Mark I, this upgraded version introduces significant enhancements that allow for continuous launching, improved launching efficiency, change in launching direction, and auto aiming capabilities.

With its two degrees of freedom, the Mark II provides precise control over the launching direction. It offers two distinct modes of operation: manual and auto. In the manual mode, users can control the launcher using a joystick, granting them direct command over the firing process. On the other hand, the auto mode utilizes a program that interacts with a phone camera, enabling automatic aiming functionality. This advanced feature ensures accurate targeting and enhances the overall user experience.

Overview



Algorithm

```
if gas pressure check is successful:  
    while (P_GasTank < gas_pressure_threshold) :    // open gas pump
```

```

while (running):      // Start the controller
    if (manual mode is enabled):
        x_direction = read_joystick_input ('x-direction');
        y_direction = read_joystick_input ('y-direction');
        ready = read_joystick_input ('launch');
        move motor in x-direction;
        move motor in y-direction;
        if ready: // Open the gas trigger to release gas and push the T-shirt
            gas release = 1;
    elif auto mode is enabled:
        frame = read_frame_from (camera);
        hands = YOLO(frame);
        if hands is detected:
            highest_confidence_x = x_of hand_with_highest_confidence (hands);
            direction = left, mid, right if highest_confidence_x in image_width[0, 1/3], [1/3, 2/3], [2/3, 1];
            // Move the motor to the desired position
            move motor to the corresponding position based on the direction;
            // Open the gas trigger to release gas and push the T-shirt
            gas release = 1;

```

System verification

• Power & Pneumatic

Provide electronic and gas resources for the entire system.

- Charge the main gas cylinder to the pressure threshold within 10 seconds, with a capacity to launch 10 T-shirts per charge. ____/ 2

• Launch

Include gas devices for launching T-shirts.

- Able to launch T-shirts greater than 30m with an initial pressure of 0.9 kpa and launch angle of 30 degrees. ____/ 5
- Capable of continuous T-shirt launching within 5 seconds. ____/ 7
- The stabilizer supports movement in 2 degrees of freedom with a reliable mechanical design. ____/ 7
- T-shirts are launched at an initial speed over 20m/s, with an acceptable impact at a distance of 5m. ____/ 3
- Multiple user functions under manual mode, ensuring entertainment. ____/ 7
- Friendly and comfortable human-machine interface. ____/ 5

• Control

Control necessary activities, including software and hardware.

- Control 3 main valves using physical triggers or digital signals, with an open interval within 100ms. ____/ 3
- Allow quick switching between manual and auto modes. ____/ 1
- Ensure quick response to joystick inputs. ____/ 2

• Automation

Program for auto-aiming functionality.

- The camera is mobile and portable. ____/ 1
- Hands detection is tolerant to vibration and robust to distance (scalable between 3m to 30m). ____/ 5
- Acceptable system response latency. ____/ 2