Specifications for Remote Water Pump Control System v.1 by Santiago Jácome

Introduction

I live in a house built on top of a small hill. On some days, the water pressure from the supplier is not strong enough to pump water all the way to the top. To solve this, I rely on large water tanks at the bottom of the hill and a water pump to transfer water to the house.

The house is older, and my landlord has explicitly requested that no modifications be made to the existing wiring or switches in the house.

Problem Statement

Currently, turning the water pump on and off requires physically going up and down a long flight of stairs. This is particularly inconvenient, especially when needing water urgently, such as before taking a shower in the morning.

Proposed Solution

The solution involves creating a system that allows remote control of the water pump switch from the top of the hill. To comply with the landlord's restrictions, this solution must avoid altering the electrical wiring of the house.

The core idea is to use a mechanical system, like a solenoid or a motor, to physically toggle the pump's switch. This actuator will be controlled by a microcontroller with wireless communication to a second microcontroller positioned at the top of the hill. The user at the top will interact with the system wirelessly to control the pump.

Requirements and Restrictions

Functional Requirements

- The system must enable remote control of the pump switch from the top of the hill.
- The mechanical actuator must be able to physically toggle the pump's existing switch up and down.
- The user must be able to tell if the pump is on or off easily from the top of the hill.
- Wireless communication must be reliable over the required distance, if one of the devices is restarted it must pair itself without user intervention.

Design Restrictions

1. **No Electrical Modifications**:
    - The existing electrical wiring or switches of the house must remain unaltered.
    - The system should rely solely on external mechanical and electronic components.
2. **Clean and Non-Invasive**:

    - The design must avoid "hacks," such as taping a servomotor directly to the switch.
    - It must be aesthetically acceptable and minimally intrusive.

3. **Ease of Removal**:
    - The system must be easy to remove within seconds, leaving no marks or damage to the house.
    - It should not require tools or complex procedures for removal.

4. **Energy Efficiency**:
    - The system must use minimal power to operate, as it may rely on batteries for wireless communication.

Proposed Components

- **Mechanical Actuator**:
    - A solenoid or motor capable of applying the necessary force to toggle the switch.
    - A mechanism to attach securely to the switch without requiring permanent fixtures.
- **Microcontroller**:
    - The ESP32-S2 Mini DevBoard, which is sold with an antenna and is compact compared to the WROOM DevBoard.
- **Wireless Communication**:
    - ESP-NOW, which has built-in auto-pairing capability and offers a large range when using the DevBoard's antenna.
- **Power Supply**:
    - A 18650 Li-Ion battery for the system with the actuator.
    - A small LiPo battery for the system at the top (remote control).
- **User Interface**:
    - A remote switch, smartphone app, or simple button interface for controlling the pump from the top of the hill.

Success Criteria

1. The system can reliably turn the pump switch on and off remotely from the top of the hill.
2. The installation does not alter or damage the house's wiring or physical infrastructure.
3. The design is clean, unobtrusive, and easily removable.
4. The system operates efficiently and effectively under regular usage conditions.