

# Developing an Automatic Potable Water Chlorinator in Response to Varying Water Conditions

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## Problem

### Global Problem

- 1.7 Billion cases of diarrheal disease caused by contaminated drinking water (1)
- 785 million people do not have access to clean drinking water. (2)
- Contaminated drinking water is directly linked to 3.4 million deaths per year (3)

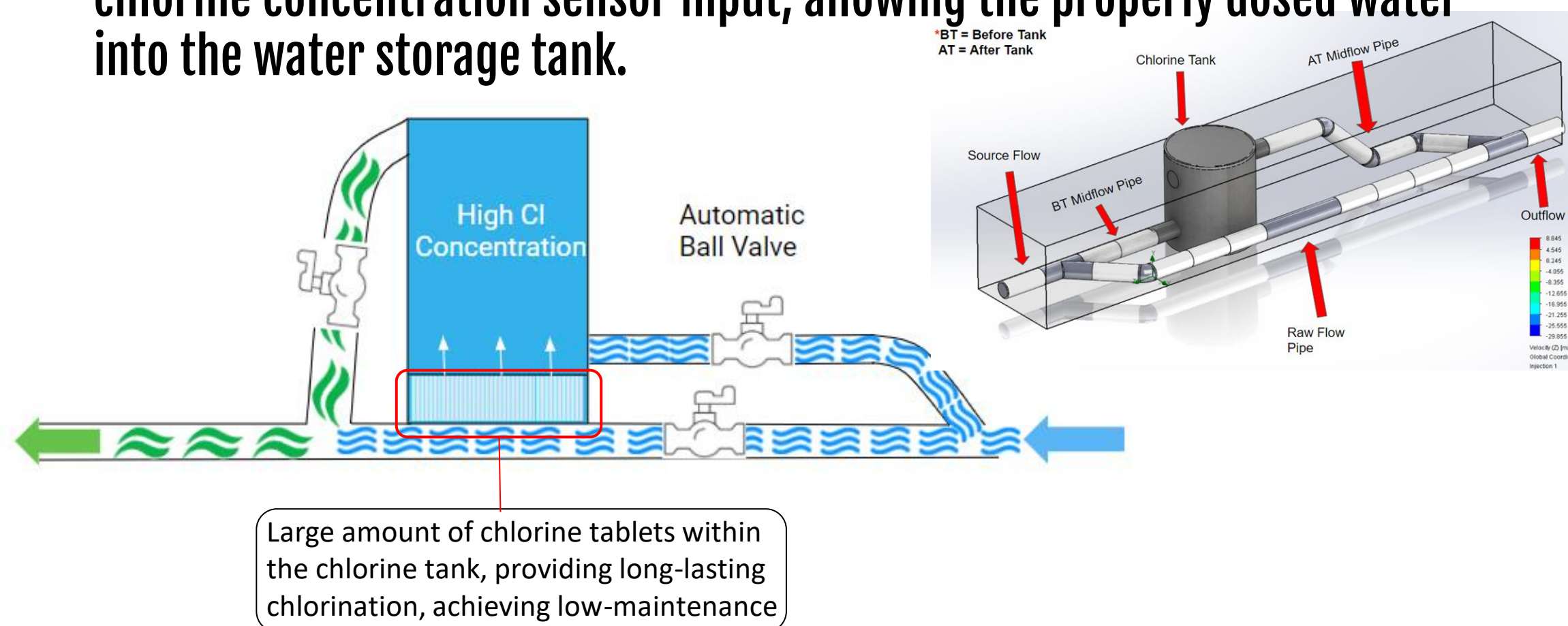
### Local Problem

- Rural Peru communities employ a manual chlorine dripping system
- Relies on worker's estimation and experience
- An automatic, accurate and low-maintenance chlorinator can significantly reduce the rate of water borne diseases



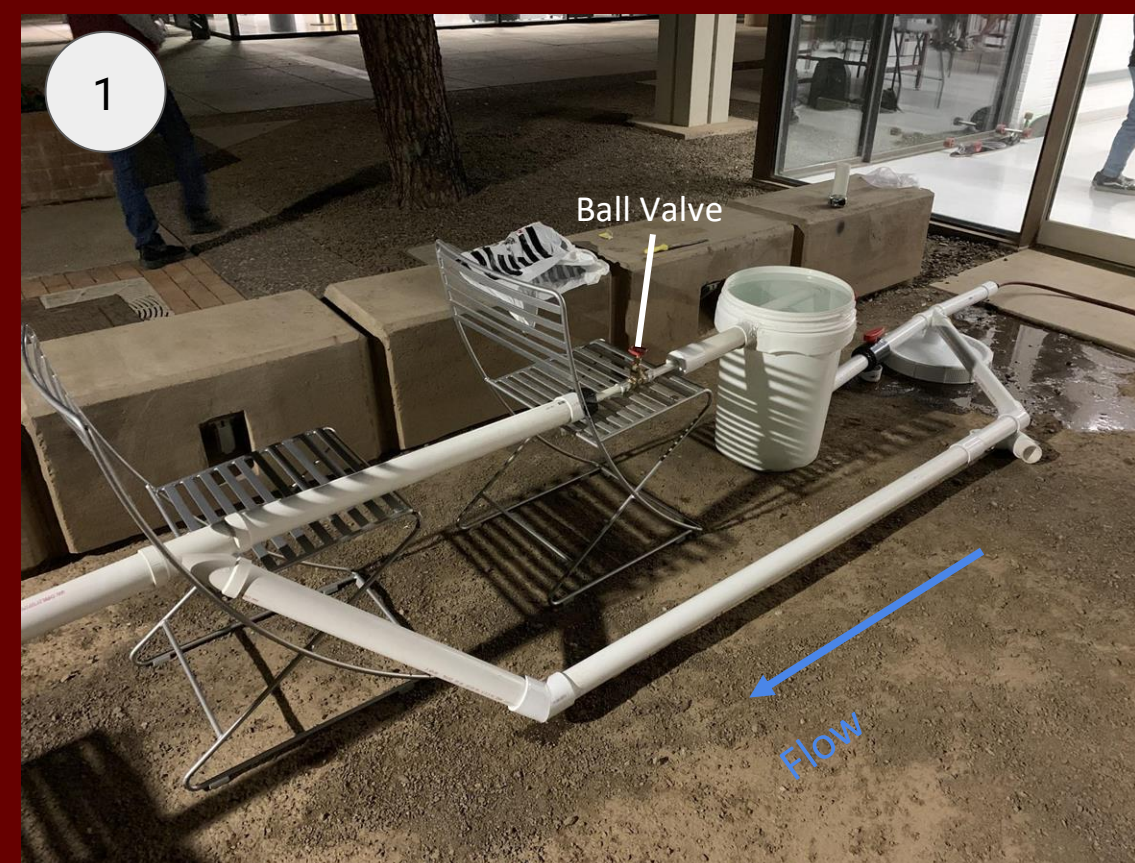
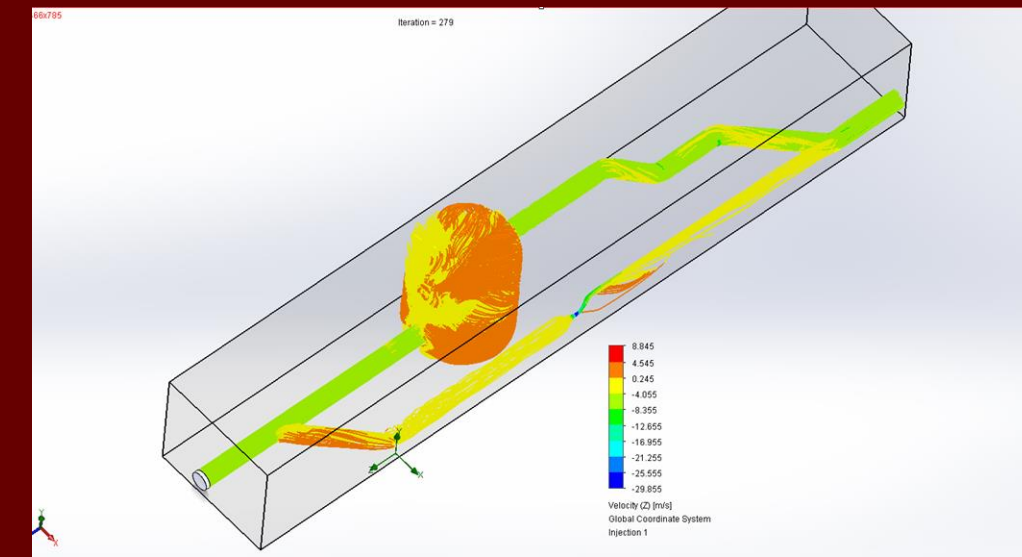
## Methods

Our chlorinator functions by diverting a portion of raw water into a tank containing constant and highly chlorine concentrated water. Then the outflow flow rate is regulated by a motorized ball valve in response to the chlorine concentration sensor input, allowing the properly dosed water into the water storage tank.



## Current Progress

### Flow Simulation



### Pipe Layout 1: Ground level inflow & higher outflow

- Constant and identical flow rate in and out of the chlorine tank, water level is stable for long period of time
  - No outflow through the raw flow pipe prior to the filling of the chlorine tank
  - Need to determine the flow through
- #### Improvement
- Need to determine the flow through the raw flow pipe
  - Replacing the first lateral tee joint to a true wye joint to distribute flow more evenly

### Pipe Layout 2: Ground level inflow & ground level outflow

- Water mostly travel through the raw flow pipe, bypassing the chlorine tank
- The chlorine tank does not fill up, and water flows back into the BT midflow pipe, forcing water through the raw flow pipe

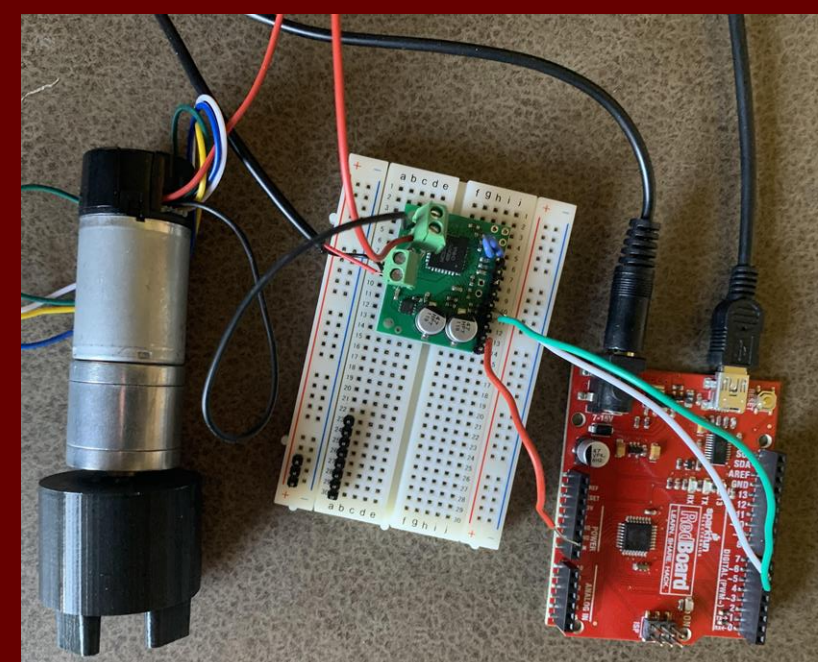
#### Improvement

- Introduce a check valve to the inflow of the chlorine tank to prevent backflow and pressure loss
- Theoretically more optimized than layout 1



### Motorized Ball Valve

- It is used to adjust the amount of chlorinated water that converges with the raw flow
- Completed the soldering of the circuit and the programming of the Arduino
- It is made to control a 1/4 in ball valve for larger control over the flow rate
- Immediate response to changes of chlorine concentration detected by the chlorine sensor



## Conclusions

- The chlorine tank of the chlorinator is able to hold consistent inflow and outflow rates, conserving energy for varying flow rates
- By positioning both the inflow and outflow at ground level, the streams would converge with little energy loss

## Future Work

- Perform the dyed water test to determine chlorine mixing time in the chlorine tank
- Determine the consistency of outflow chlorine concentration under varying flow rates
- Adjust chlorine tank layout to maximize chlorine mixing time and achieve consistent concentration

## References

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