



AN-Najah National University Faculty of Engineering & Information Technology
Computer Engineering Department

Graduation Project II

Flood control system

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Disclaimer:

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Abstract :

Not all people are aware about the danger of increasing the percentage of rain water in the ground, also the problem of wasting water and not using it in other fields of life. So many people are exposed to losing their lives because of this water and not draining it in the right way.

The project aims to create a system that detects the level of water in the ground to deal with this problem automatically to save people's lives. Moreover, to collect and store the rain water rather than to be wasted.

The system contains a lot of tools such as soil moisture sensor, water quantity sensor, traffic light (LEDs), water drain pipes, automatic doors and water pump. Soil moisture sensor to measure the volumetric water content in soil, when water increased, all traffic lights will turn red and automatic doors are closed. After that the water drain pipes are open to drain water into tanks inside ground. During the conduct of all this process, a message will be sent to the Civil Defense to come to the designated area, and a state of emergency.

In the other hand, if the water quality is good the system will pump it to other tanks to be used in agriculture fields. And if the water was polluted then the system will pump it to other tanks to be disposed. There are similar projects. What distinguishes our project is to preserve pure water and use it to irrigate crops in desert areas that need water by storing it in underground pipes in different unused wastewater pipes, and pumping it to areas to be determined by officials later.

Chapter 1: Introduction

Statement of the problem:

A flood is an overflow of water that submerges land that is usually dry, also is natural disaster that threatens societies especially in the lower regions.

There are several types of floods but in our project, we care about internal and sudden floods that occurs inland not in a coastal area which happens because of rainfall. Rain causes inland flooding in two ways. Firstly, it can happen with steady rainfall over several days.

Secondly, it can happen because of a short and intense period of rainfall. So, when heavy rains come and water levels rise in ground then torrents of water go on unsuspecting households.

Objectives:

No matter what is the cause of a flood, it can have devastating effects on your community. There are actually many dangerous flooding effects. Besides physical danger, floods also cause economic problems, social problems, loss of lives, property damage and Psycho-social flooding effects.

Therefore, our project came to mitigate and reduce the effects of floods in order to preserve public safety and to preserve people's lives and property. In addition, there are tanks in the infrastructure to take advantage of the flood waters and exploit them in agriculture if the water is suitable based on the percentage of its pollution or pumping the water to unusable tanks.

Significance of the work:

Floods can happen anywhere in the world, there are certain places that are more prone to flooding so if this project exist in these areas that's helps the government to save people, property and overcome this disaster with the least possible losses and not wasting water then using it in other fields.

Organization of the report:

In this report, we illustrate the idea in its full details. Going through the report you can first see the constraints we faced during our work including equipment, tools we used and earlier course work. Then, the methodology of our work is extensively explained. Next chapter states our results and a discussion to interpret and compare the results.

Ending it up with the conclusion of the whole work and what is our vision for the future to improve our work.

Chapter 2: Constraints, Standards/ Codes and Earlier course work

Constraints:

While working, we have faced a series of problems and challenges that we have fortunately overcome.

One of these challenges is our project contains a electronic parts and water so we afraid to mix two part to each other because of that we took care when work with water for fear of damaging electronic parts. also when we use more than one servo motor that needed a voltage source greater than that needed by one motor, so when using the source from the Arduino, the

motor could not raise the doors correctly. So we used a battery to supply the motor with the required voltage.

Hardware and Standards Codes:

The following list contains the hardware components that have been used in our project:

- **Arduino Due.**
- **2 Servo Motor.**
- **2 HC-SR04 Ultrasonic Sensor.**
- **Traffic Lights.**
- **2 water pump.**
- **Buzzer Module.**
- **Soil Moisture Sensor.**
- **Water Turbidity Sensor.**
- **HC-05 Bluetooth module.**
- **Relay.**
- **12 &6 volts battery.**
- **Connecting wires.**
- **Bread board.**

Arduino Due:

The Arduino Due is a microcontroller board based on the Atmel SAM3X8E ARM Cortex-M3 CPU. It is the first Arduino board based on a 32-bit ARM core microcontroller. It has 54 digital input/output pins (of which 12 can be used as PWM outputs), 12 analog inputs, 4 UARTs (hardware serial ports), a 84 MHz clock, an USB OTG capable connection, 2 DAC (digital to analog), 2 TWI, a power jack, an SPI header, a JTAG header, a reset button and an erase button. The board contains everything needed to support the microcontroller; simply

connect it to a computer with a micro-USB cable or power it with a AC- to-DC adapter or battery to get started. The Due is compatible with all Arduino shields that work at 3.3V and are compliant with the 1.0 Arduino pin out.

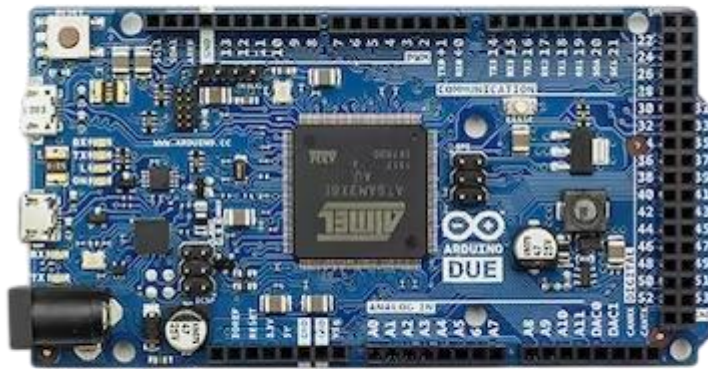


Figure 1: Arduino

Servo Motor:

A servo motor is precisely controlled by the width of a pulsed signal corresponding to the angle that the servo motor is rotated. The SG90 servo rotates to angles between 0 and 180. We used it to rotate (open and close) the doors.



Figure 2_: Servo Motor

HC-SR04 Ultrasonic Sensor :

Ultrasonic sensors use sound to determine the distance between the sensor and the closest object in its path. The sensor sends out a sound wave at a specific frequency. It then listens for that specific sound wave to bounce off of an object and come back. The sensor keeps track of the time between sending the sound wave and the sound wave returning.



Figure 3 : HC-SR04 Ultrasonic Sensor

Traffic Lights :

Traffic lights display module, high brightness, very suitable for the production of traffic light system model. It is featured with its small size, simple wiring, targeted, and custom installation. It can be connected PWM to control the brightness of the LED.



Figure 4 : Traffic Light

Water Pump :

The pump system in the well water system has the job of raising water out of the well. It will send the water through the pipes under pressure to wherever you need it.



Figure 5 : water pump

Soil Moisture Sensor:

Soil moisture sensors measure the water content in the soil and can be used to estimate the amount of stored water in the soil horizon. Soil moisture sensors do not measure water in the soil directly. Instead, they measure changes in some other soil property that is related to water content in a predictable way.

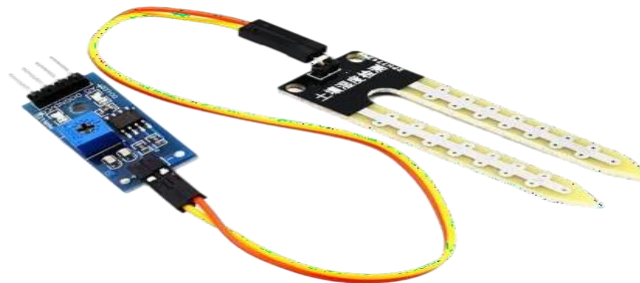


Figure 6 : Soil Moisture Sensor

Water Turbidity Sensor:

The water turbidity sensor detects water quality by measuring the levels of turbidity. It uses light to detect suspended particles in water by measuring the light transmittance and scattering rate, which changes with the amount of total suspended solids (TSS) in water. As the TSS increases, the liquid turbidity level increases.

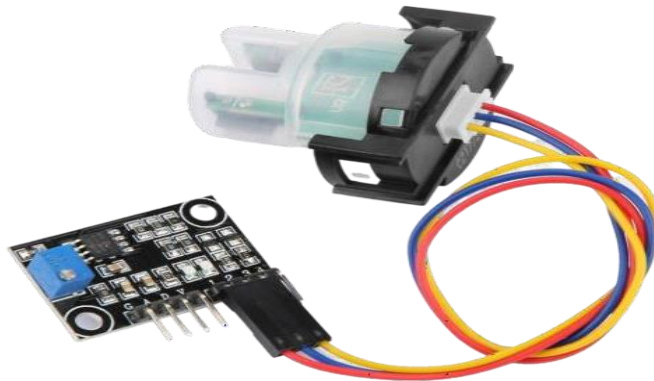


Figure 7 : Water Turbidity Sensor

HC-05 Bluetooth module:

This module to communicate between two microcontrollers like Arduino, or communicate with any device with Bluetooth functionality like a phone or laptop. The module communicates with the help of USART at 9600 baud rate hence it is easy to interface with any microcontroller that supports USART.

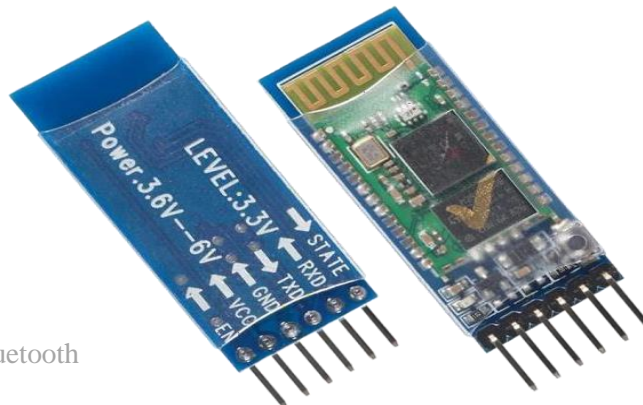


Figure 8 : HC-05 Bluetooth

Buzzer module:

An Arduino buzzer is also called a piezo buzzer. It is basically a tiny speaker that you can connect directly to an Arduino. You can make it sound a tone at a frequency you set. The buzzer produces sound based on reverse of the piezoelectric effect.



Figure 9 : Buzzer Module

Earlier course work:

PIC Lab, Microcontroller, microprocessor, and Digital3 courses have helped us to implement this project and understand Arduino better.

Chapter 3: Literature review

Floods can happen on flat or low-lying areas when water is supplied by rainfall or snowmelt more rapidly than it can either infiltrate or run off. The excess accumulates in place, sometimes to hazardous depths. Surface soil can become saturated, which effectively stops infiltration, where the water table is shallow, such as a floodplain, or from intense rain from one or a series of storms.

Floods can also be a huge destructive power. When water flows, it has the ability to demolish all kinds of buildings and objects, such as bridges, structures, houses, trees, cars. For example, in Bangladesh in 2007, a flood was responsible for the destruction of more than one million houses. And yearly in the United States, floods cause over \$7 billion in damage.

Floods causes loss of life. For example, in Indonesia in 2004, a flood was responsible for 230,000 loss of life.

Therefore, our project checks if there is a possibility of flooding in the streets by using soil moisture sensor and ultrasonic sensor, if there is a possibility of flooding, the system tries to get rid of it with the least possible losses.

Another part of our project, the water conservation and drainage system for use it in other fields based on the percentage of its pollution by using the water quality sensor.

Chapter 4: Methodology

The flood control system includes 3 parts:

Flood probability check part:

In this part, the system checks the soil moisture and water level in the street and tries to get rid of flood water without losses.

We use these components to do this part:

- **2 Servo Motor.**
- **HC-SR04 Ultrasonic Sensor.**
- **Traffic Lights.**
- **Soil Moisture Sensor**
- **Buzzer Module.**
- **HC-05 Bluetooth module.**

The following design is a circuit represent interfacing this part with the Arduino:

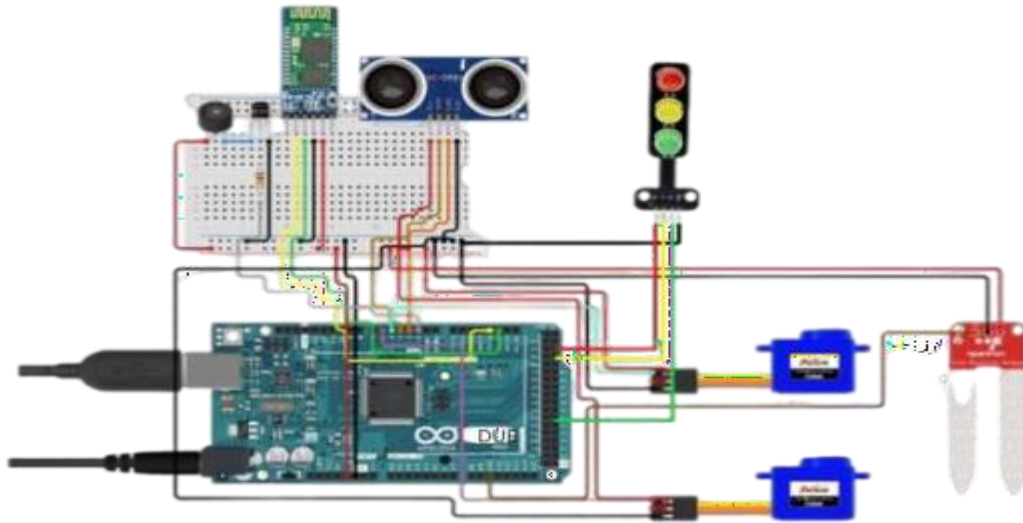


Figure 10 : Flood probability check part circuit

Code Flows:

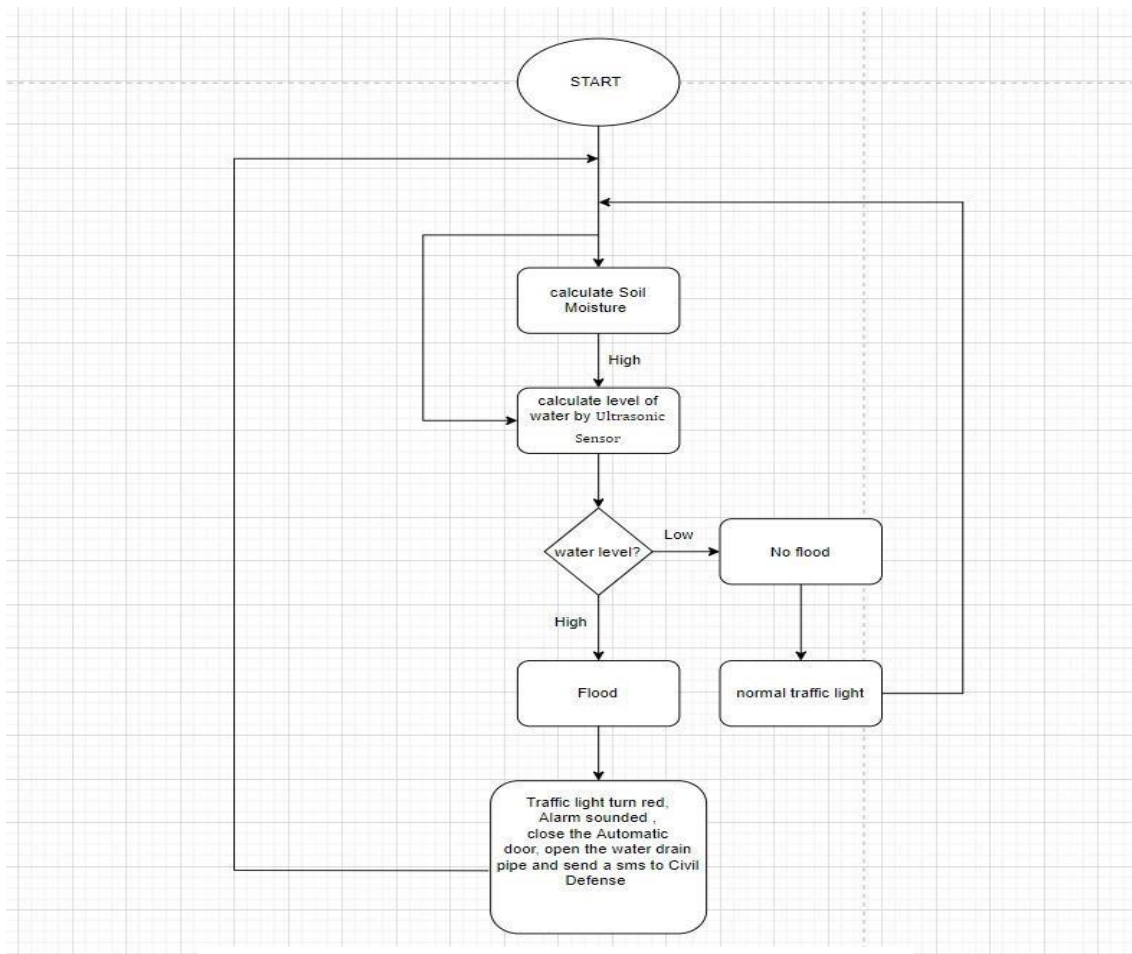


Figure 11 : Flood probability check part Flows chart

water drainage part:

In this part, the system drains the flood water and uses it in other fields by using the water turbidity sensor to determine if the water is suitable for agricultural use or not.

We use these components to do this part:

- **HC-SR04 Ultrasonic Sensor.**
- **2 water pump.**
- **Water Turbidity Sensor.**
- **Relay.**
- **12 volts battery.**

The following design is a circuit represents interfacing this part with the Arduino:

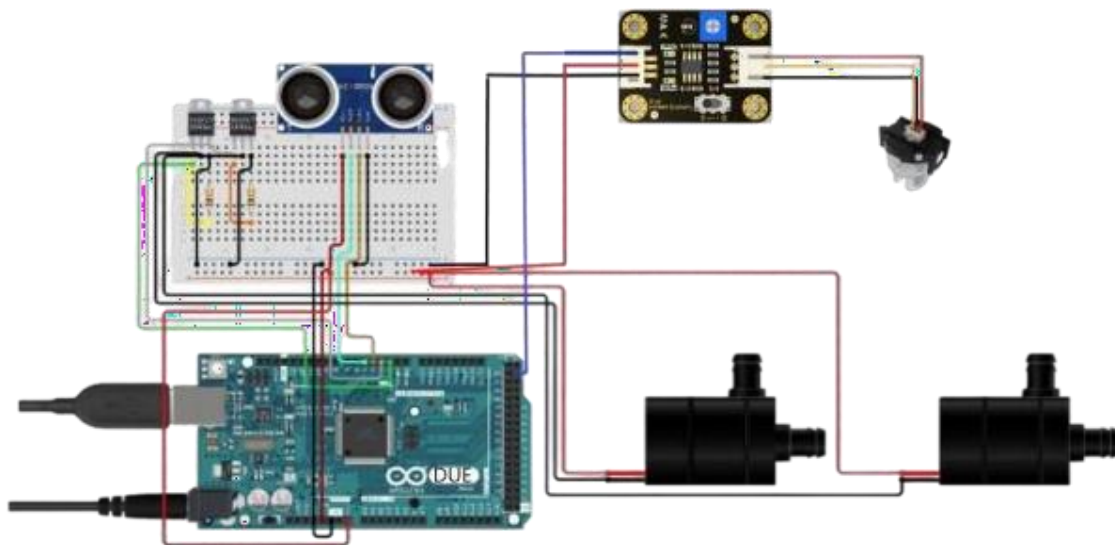


Figure12: water drainage part circuit

Code Flows:

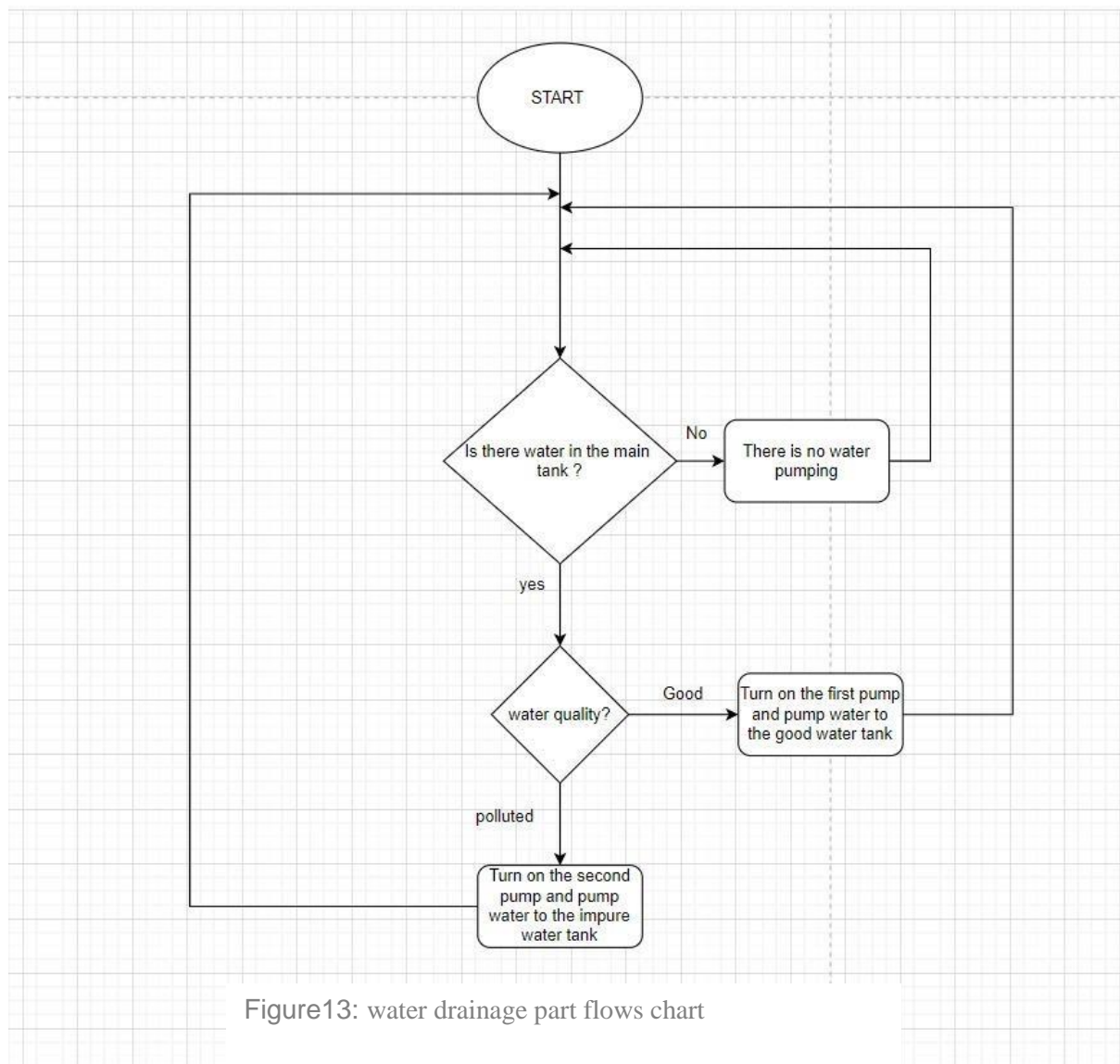


Figure13: water drainage part flows chart

Mobile Application :

This application for mayor, when a flood occurs, a message is automatically sent to the civil defense, also the mayor can control the doors , the water drain pipes and water pumps through the application.

Home page in our app:

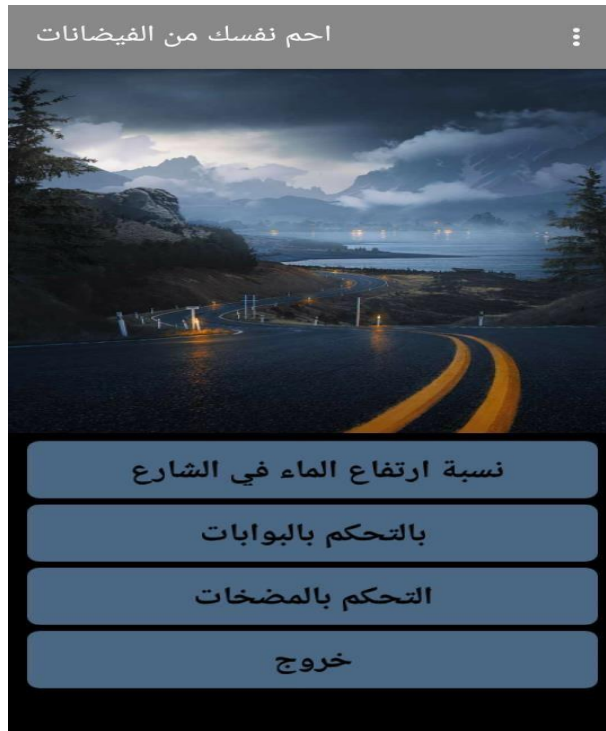


Figure 14:home page in mobile app

Doors and the water drain pipes control page:

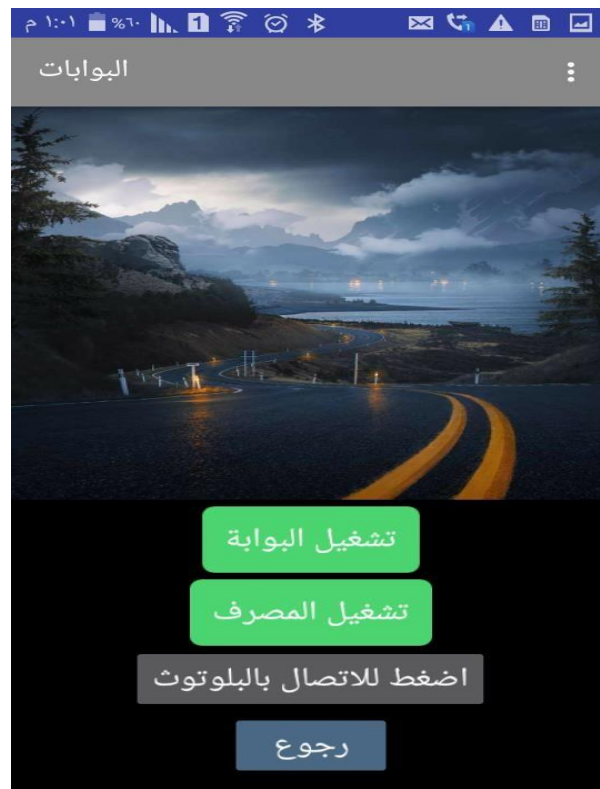


Figure 15: doors and the water drain pipes control page in mobile app

water pumps control page:



Figure 16: water pumps control page in mobile app

Messages will be sent when flood is occurring:



Figure 17: The message that reaches the civil defense

Chapter 5: Results and Discussion

In the final stage, the project fulfilled the requirements related to checking the soil moisture percentage and the water level in the streets to detect if there is a possibility of a flood. In the no flood case, the traffic light is normal and the doors are open and water drains are closed.

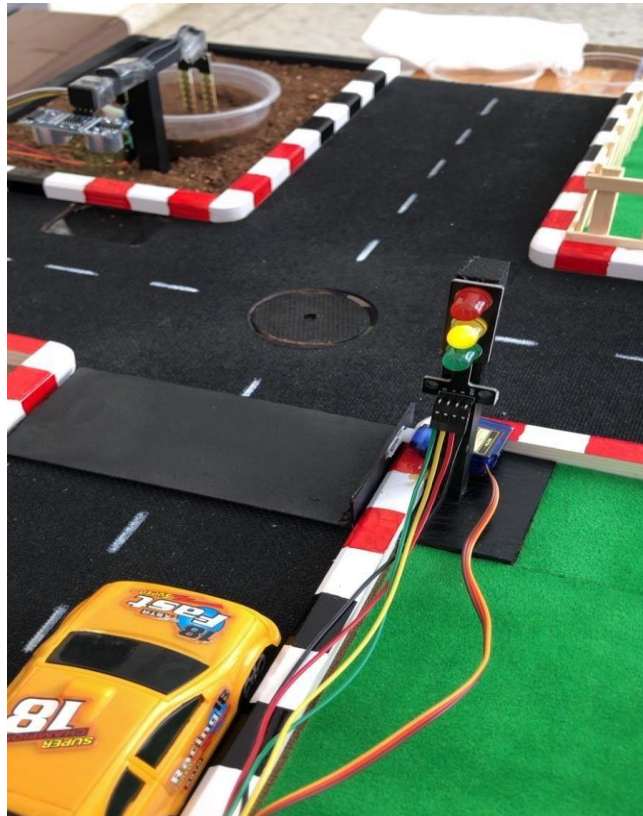


Figure 18:no flood case

When flood is occur (the water level in the street is high), the traffic lights will turns red, the doors will be closed to prevent the passage of cars and people and only allows water to pass from below and the water drain opens to drain the water into underground tanks.

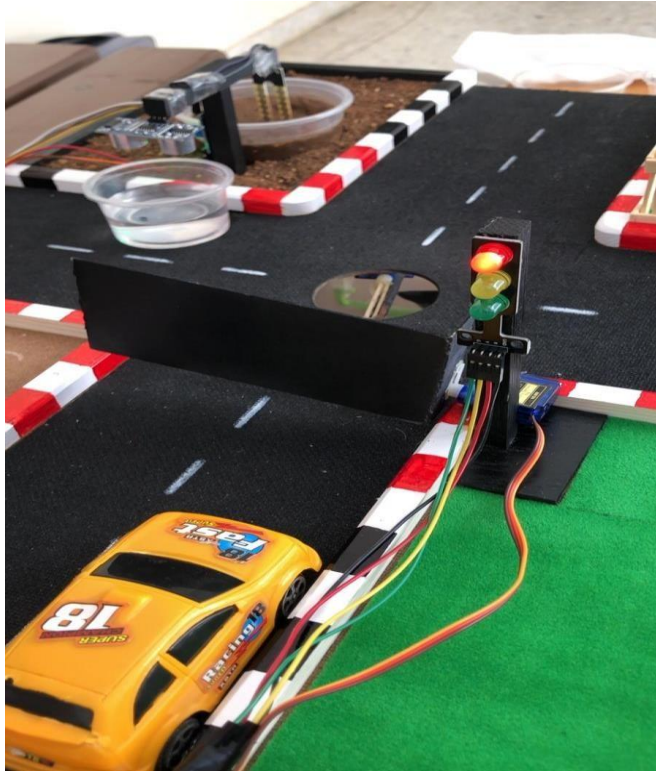


Figure 19: flood case

After drains water into underground tanks, the system measure the percentage of water pollution by using the water quality sensor, then determine in which tanks this water is pumped .

If the water is polluted, the polluted water pump is opened to pump the water to the polluted tank.

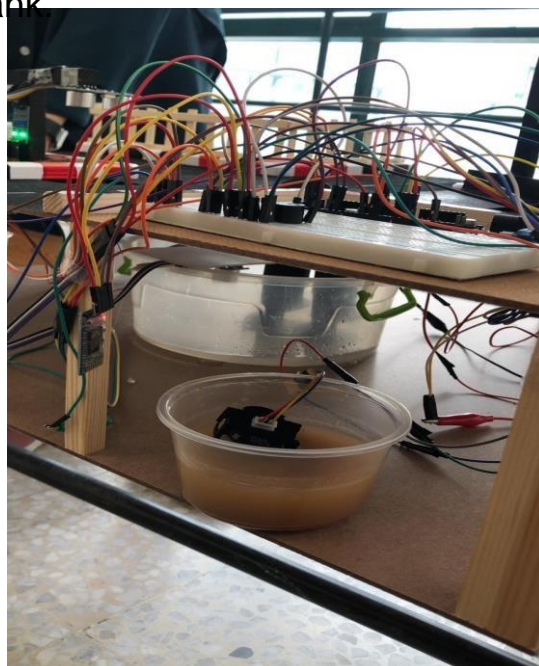


Figure 20: polluted water

Polluted water tanks after water is pumped

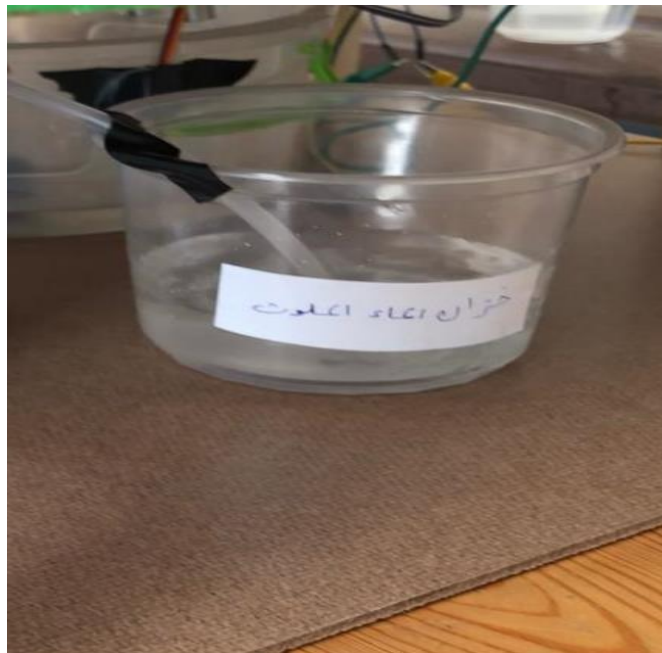


Figure 21: polluted water tank

If the water is not polluted, the unpolluted water pump is opened to pump the water to the unpolluted tank.

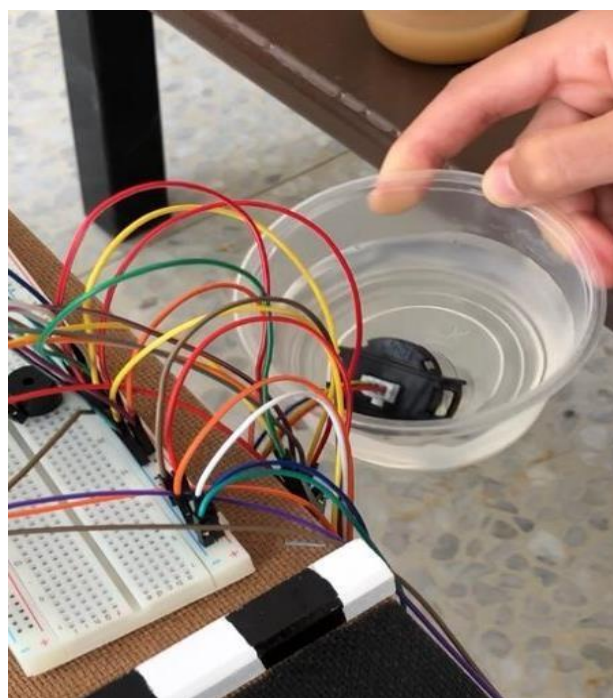


Figure 22: not polluted water

Unpolluted water tanks after water is pumped

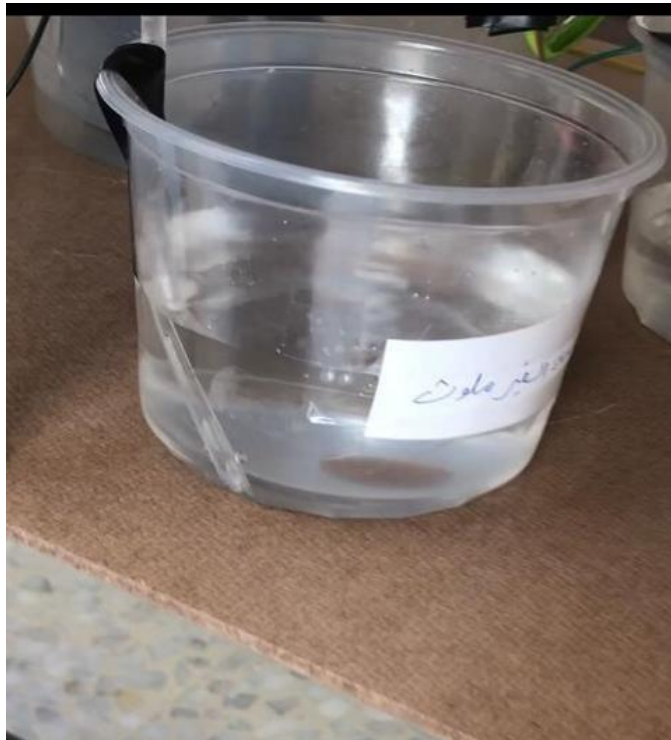


Figure 23: not polluted water tank

Chapter 6: Conclusion and Future work

At the end of the project, we were able to build a prototype of a system for checking the possibility of flooding and controlling it with minimal losses, which can take advantages from flood water in other areas.

For a future work, we think in the future we can use this polluted water by Recycle polluted water and use it for Irrigate crops, This water can be distributed to many desert areas, thus reducing desert lands and increasing agricultural land and agricultural production for these countries. All we need is a good infrastructure, tanks that can accommodate this water, drainage pipes and pumps that operate automatically, with periodic follow-up, maintenance and cleaning of these tanks.

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