# Rain detection & water level controlling using 8051 Microcontroller

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## Abstract:

The main theme of our project is to save water, in addition to water level controlling in the tank, we will open the cap of the tank if we detect the rain water and not only these, we have added another feature to our device by adding buzzer (alarm), so that it gives alarm when rain falls which help to bring back the items (clothes, eatables, etc.) that we have kept in sunlight for drying.

This project can be understood well by dividing it into three parts:

- Water level controller
- Rainfall detection
- Adding alarm

In first part will help us in controlling the water motor by sensing the water level in a tank. This system monitors the water level of the tank and automatically switches ON the motor whenever the tank is empty and switched OFF when the tank is full. In second part we detect rain water and in the third part we let the alarm to make sound if we detect rainfall.

### 1. Introduction:

The project is water level sensing in water tanks, controlling water level automatically and detection of rain and giving alarm if rain is detected. This approach would help in reducing water wastage as we can even use the rain water by allowing it into the water tank and the alarm will help the household men/women in bringing the items that were kept in sun for drying.

Furthermore, we fix a LCD for indicating the level of water in the tank and this LCD also indicates the rainfall.

Water is most commonly used resource for daily consumption, agriculture, industry. So, efficient use of water by monitoring the tank level of water is a potential constraint for home/office. Automatically controlling the motor by detecting the level of water would save lot of water.

Water, one of the great natural resources should be utilized in proper form. But a huge amount of water is being wasted during daily life due to lack of control. Our proposed system guarantees to accumulate a good amount of usable water every day.

### 2. Review work:

We briefly review the recent work that we have done on Automatic water level controller and rain water detection.

#### 2.1. Water Level Detection

For water level detection, many have used direct sensors that are available in market and in later stages many have prepared their own sensing circuits using transistors.

#### 2.2. Water level indication

After detection of level of water in the tank, one

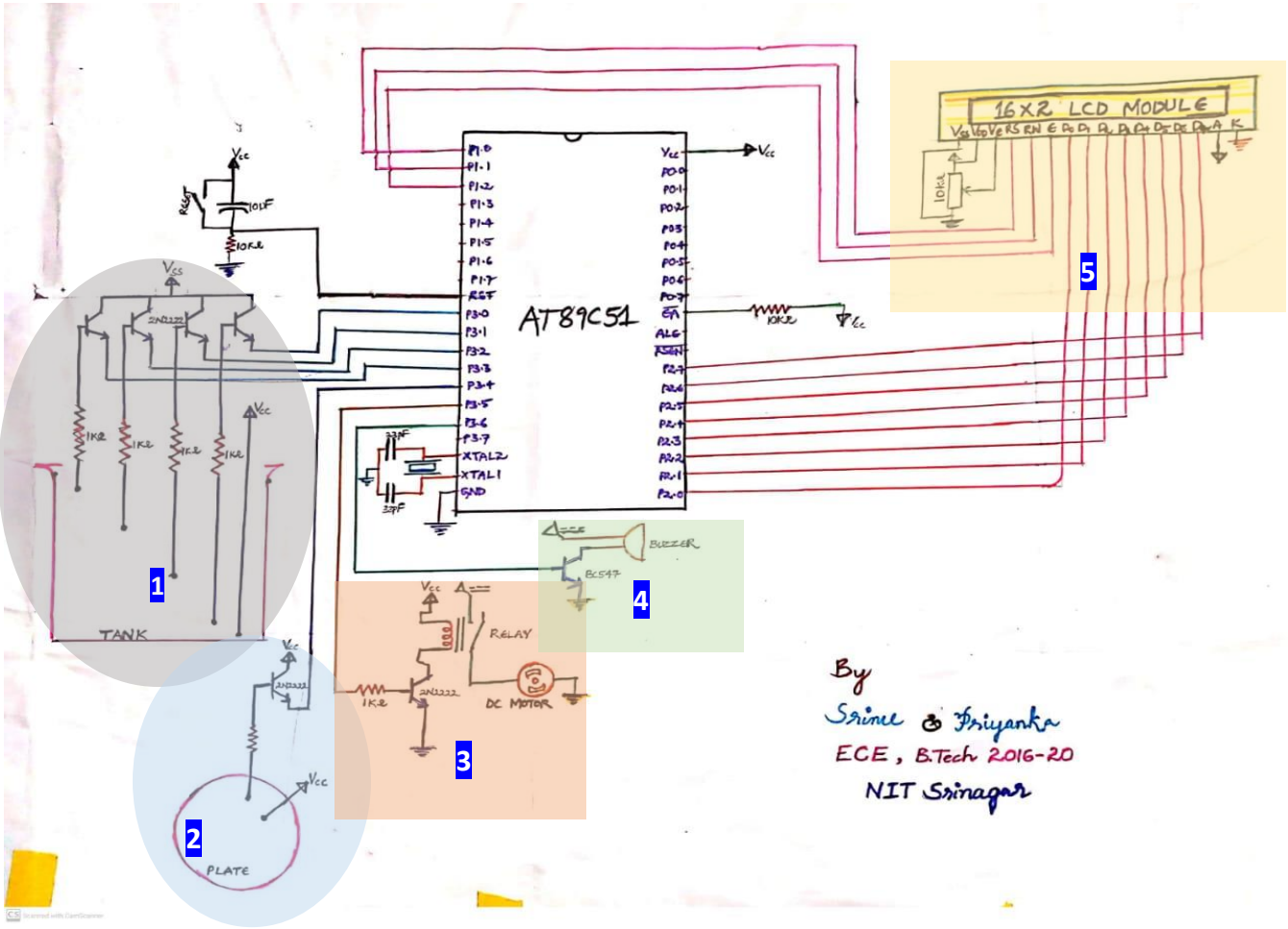


Figure 1. Circuit diagram of Rain detection and water level controlling, water level sensing (Sect.1), rain detection (Sect.2), automatic switching (Sect.3), an alarm (Sect.4) and LCD (Sect.5)

has to show the level of water in the tank by using LEDs or display devices like LCD screens.

### 2.3. Automatic Level controller

For switching ON/OFF the motor automatically, one have many switching devices like Bipolar Junction Transistor (BJT), Relay, Solid State Relay (SSR), Metal Oxide Semiconductor Field Effect Transistor (MOSFET)/ IGBT, Darlington Transistor. Most people used Relay (Electro Mechanical Relay) as switching device due to its outstanding properties.

### 2.4. Rain Detection

For rain detection, there are direct rain detection sensors available in the market and we can even make our own rain sensing circuit using the transistors.

### 2.5 Interfacing Buzzer with Microcontroller

We have interfaced Buzzer with microcontroller for alarm by giving instruction to the micro-controller.

## 3. Circuit & Design Principle:

In this section we explain about our rain water & water level controlling circuit diagram shown in figure 1. This project design principle is based on "Water conducts electricity" and we are detecting water level in tank and rain detection using this principle.

This section is subdivided into four section as shown in the figure 1.

### 3.1. Water Level Sensing

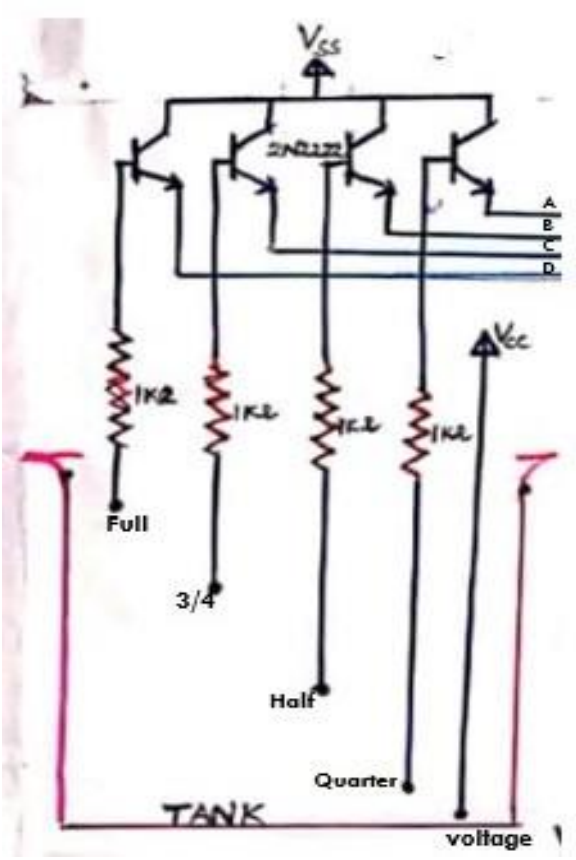


Figure 2. Water level sensing and inputting A, B, C, D to Microcontroller

Here the emitter end of the transistors (A, B, C, D) are connected to microcontroller, supply voltage of 12V is given to bottom of the tank. Whenever the water touches the "Quarter" level, as the Vcc is in bottom of water, conduction takes place at "Quarter"(base terminal of transistor) due to Vcc.

This base current flows to emitter and the transistor gets active, as transistor is active the collector current also flows to emitter. In short we can say that if transistor gets active then it indicates that the transistor has sensed the particular level in the tank. This emitter current is given as input to the microcontroller, based on the input that gets, microcontroller gives the output as per our code.

Similarly the transistors gets active whenever the water reaches "Half", "3/4" and "Full" levels. The emitter currents of the transistors are given as input to the microcontroller. If water level won't touch "Half" then the transistors will be inactive and there won't be any emitter current.

### 3.2. Rain Detection

Here the emitter of the transistor (E) is connected to the microcontroller, a supply voltage (Vcc) of

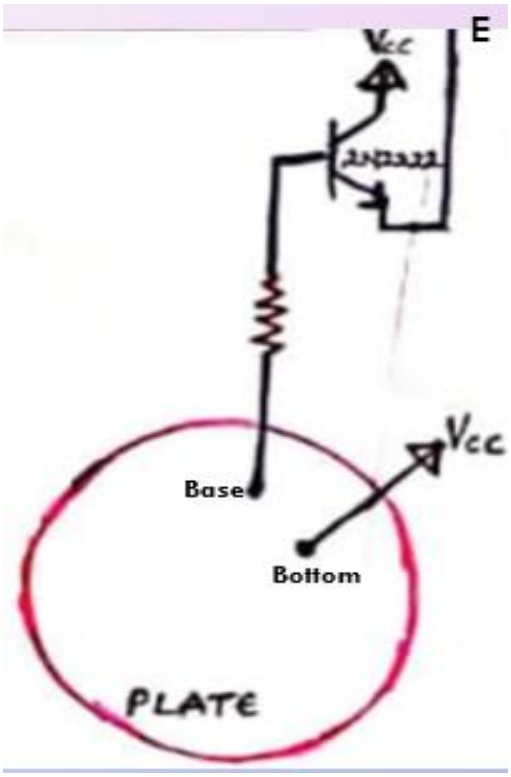


Figure 3. Rainfall detection and inputting E to Microcontroller

12V is given to the bottom of the plate, whenever the rain falls, there will be conduction between the “Bottom” and “Base” terminal of BJT.

When there will be conduction then transistor gets active and emitter current flows and when there is no conduction then emitter current won’t flow to microcontroller as input signal.

### 3.3. Automatic Switching

There are different switching devices available, Relay is one of them and the relay that we are using here is an electro mechanical relay, a 5 pin relay.

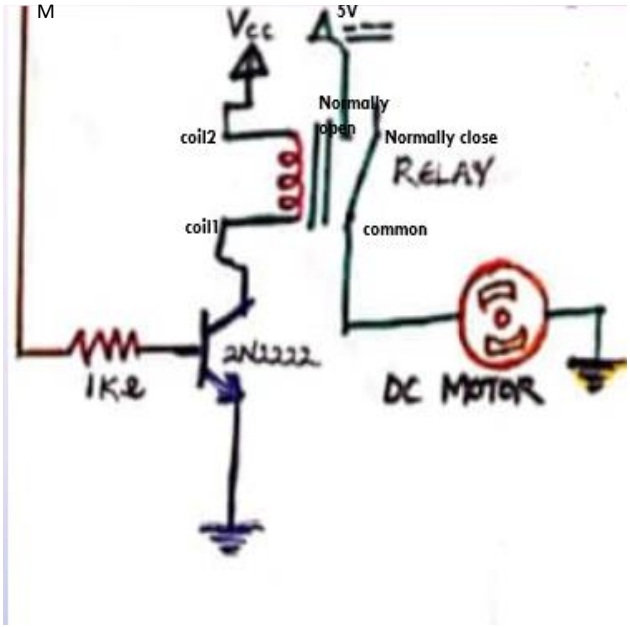


Figure 4.Automatic motor switching using Relay

Whenever the transistor will be active, the coil will be magnetized and attracts the switch, as the switching taken place, motor gets ON.

Whenever the transistor will be inactive, the coil won’t be magnetized, so the switch will be in ‘Normally close’ position, motor will be OFF condition. Placing a PN junction diode in parallel to the coil will be good because when the transistor gets inactive suddenly then the magnetic energy stored in the coil will be changed to voltage and because of this voltage heavy currents might flow through transistor, because of which the transistor might burn. So, placing diode across the coil will decrease the flow of heavy currents through transistor.

### 3.4. Alarm

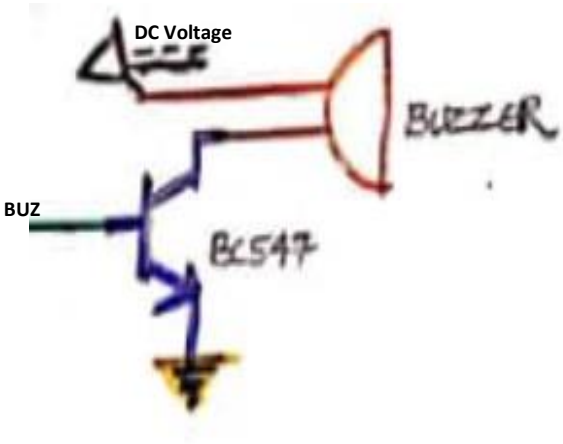


Figure 5. Circuit for Alarm when rainfalls

The end ‘BUZ’ is connected to microcontroller, From 3.2, we can detect rainfall, if we detect rain fall then we make BUZ high, if no rainfall then we make BUZ low. Whenever the pin of the microcontroller is high then the transistor will be in active state, the buzzer produces sound. If the pin is low then the transistor will be inactive, so the buzzer won’t produce any sound.

### 3.5 Liquid Crystal Display

8 data pins (D0, D1, D2, D3, D4, D5, D6, and D7) of LCD is connected to any PORT of microcontroller (We connected to PORT2 as shown in Figure 1).

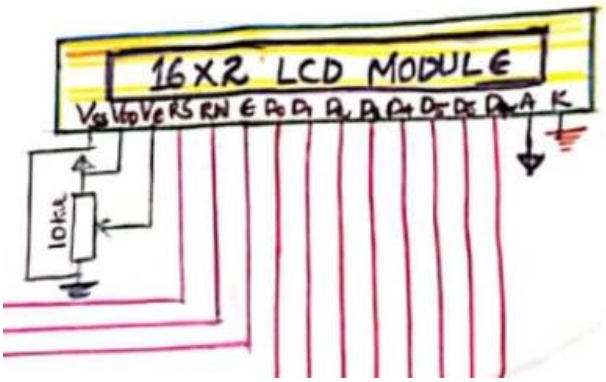


Figure 6. Liquid Crystal Display

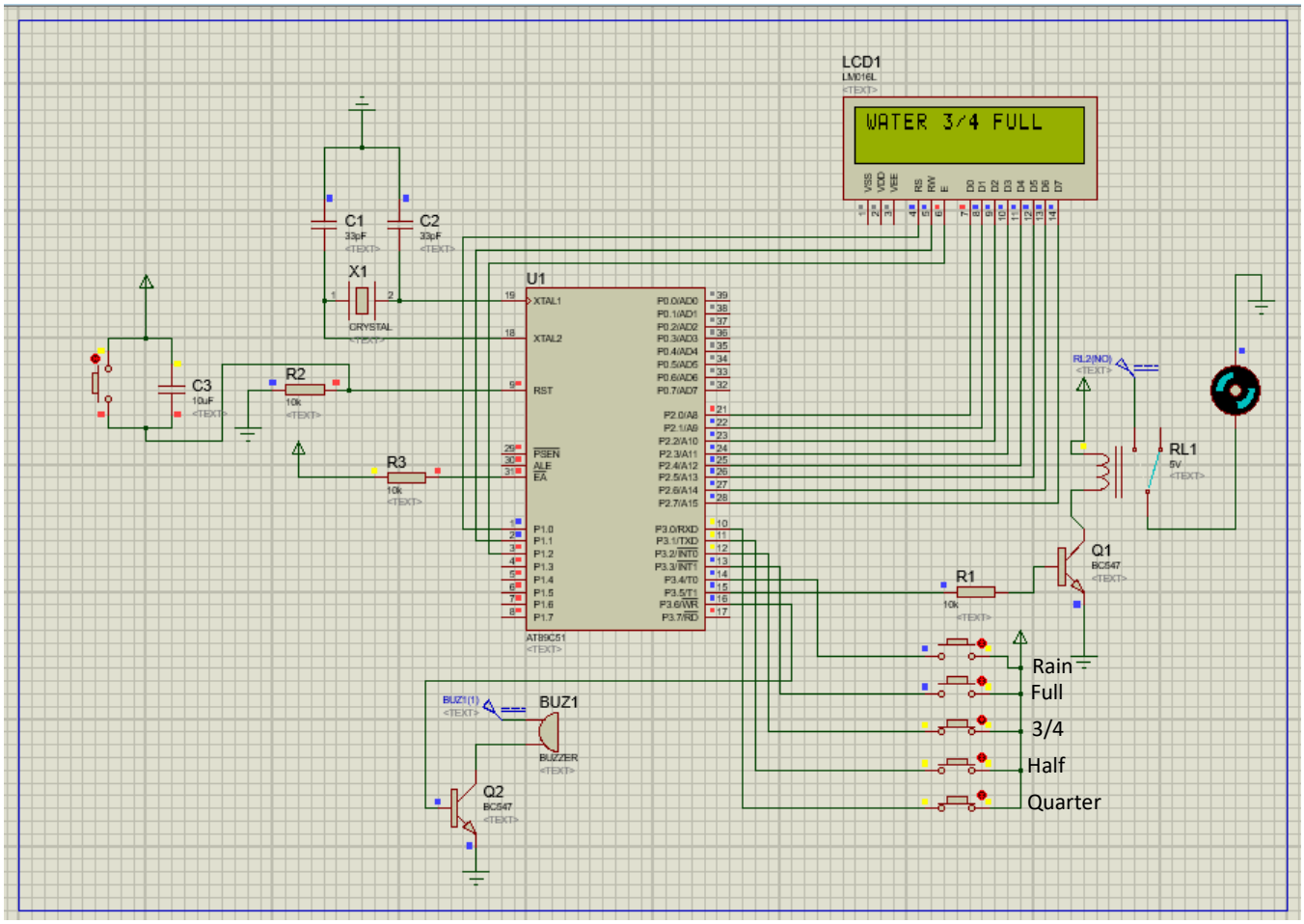


Figure 7. Circuit simulation output on Proteus software

Register select (RS), Read/Write (RW) and High/ Low (E) of LCD is connected to three pins of micro-controller (we connected to PORT1 first three pins). Vss, Vdd, Ve is connected to potentiometer for contrast adjusting. Anode (A), cathode (K) is connected with positive, negative terminal of battery.

## 4. Code & Results:

We have written the code for this project in 'Embedded C' and the code is made available in our GitHub repository, link to the code is https://github.com/srinu6/Water-level-controller-using-8051-Microcontroller.

Proteus software simulation output is shown in Figure 7. For simulation we have used switch Buttons instead of BJT and water in a tank. In figure 7 the buttons of 'Quarter', 'Half', '3/4' are closed so the output on LCD is showing "3/4" full. Based on alarm we can open the cap of the tank.

| Seq. No. | Switch button (Quarter) | Switch Button (Half) | Switch button (3/4) | Switch button (Full) | Switch button (Rain) | Tank level | Motor | Alarm |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 1 | Empty | ON | ON |
| 2 | 1 | 0 | 0 | 0 | 0 | Quarter | ON | OFF |
| 3 | 1 | 1 | 0 | 0 | 1 | Half | ON | ON |
| 4 | 1 | 1 | 1 | 0 | 1 | ¾ | ON | OFF |
| 5 | 1 | 1 | 1 | 1 | 0 | Full | OFF | ON |

Table 1. Tabular result for the above Proteus simulation in Figure 7.

### 4.1 Flow chart

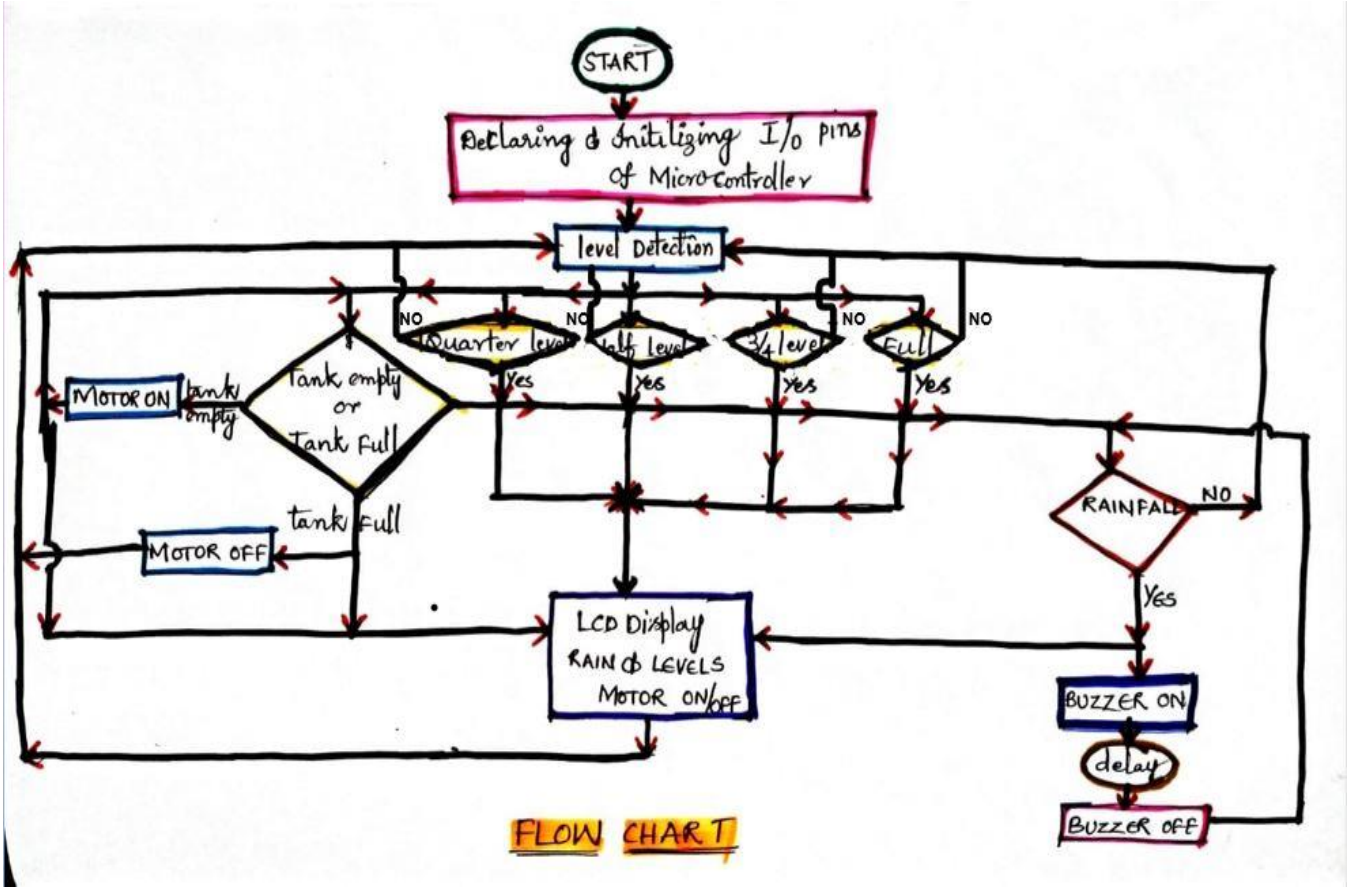


Figure 8. Flow chart

### 5. Conclusion & Future scope:

Automatic water level controller helps in swimming pools, overhead water tanks and in industries and rain detection with alarm will be helpful for household Women/Men in getting the items like clothes that are kept in sunlight for drying and one can even open the cap of the overhead tank while raining and by this we can even utilize rain water.

The future scope of this project would be adding a mechanical device that can open and close the water tank cap automatically, while in times of rain, this can save lot more water and we can make these all in one device available to user for low cost.

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