WATER WASTAGE REDUCTION IN MUNICIPAL SECTOR USING DTMF TECHNOLOGY

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ABSTRACT

The increasing population and the wide expansion of residential areas have increased the need of proper distribution of water. This distribution of water in every house within different areas needs the control and monitoring for preventing the wastage of water. Different technologies have been studied to distribute/supply the water to each and every residential area. This paper provides automatic water distribution using DTMF technology in the municipal sector

Keyword: - *DTMF, DTMF decoder, Relay driver, Relay, Electromagnetic Valve*

1. INTRODUCTION

The municipal water supply is costly, because of no regular working of valve operator. The possibility wastage of water can be increase. Due to overall status municipal water supplies is in loss. So we develop final year project to protect the loss by municipal mistakes, with our deep knowledge of previous years. Circuit implemented here with DTMF frequency (DUAL TONE MULTIPLE FREQUENCY). DTMF frequency is available in mobile phones and landline phones also. The circuit is placed in only water tank area. The circuit (water) can be controlled, without leaving office and in low consumption of power. Here circuit uses DTMF to binary decoder circuit, this circuits output is 4-bit binary. For many controls there is decoder circuit requires. So Binary to decimal driver circuit is used, now we have 0-9 output, it can be easy to control up to nine devices. Here relay can be drive using relay driver circuit. Eight Relay is interface with AC mains and eight valves is interface with relay. If any relay is energies the connected valve should on and water can flow through valve, in this way we can control here maximum nine relay. If we want to increase the number of relay and valve, then decoder is used. When we press switch of transmitter mobile or landline phone, then binary equivalent number is received, after that binary to decimal equivalent output selected. The output is given to flip-flop; relay driver circuit drives the relay and relay is used to drive the AC operated valve [4, 5, 14, 15]. Dual-tone multi-frequency (DTMF) is an international signaling standard for telephone. The detector part of early DTMF systems consisted of analog implemented band pass filter-banks, which were tuned to the eight standard frequencies. As analog lines as well as many other analog systems were converted to digital, researchers became interested in digital DTMF detectors. Digital implementation has many advantages over analog implementation such as accuracy, stability, re-programmability, and chip count; that is, instead of using several analog chips for detecting multi-channel DTMF tones, only a digital signal processor (DSP) chip is used for all channels [1, 13].

2. BACKGROUND

A DTMF signal Consist of two superimposed sinusoidal waveforms whose frequiencies are chosen from a set of eight standardized frequiencies.For example, by pressing the ‘1’ button on the touch-tone telephone keypad in figure 1, a signal consisting of a 697 Hz sinusoid and a 1209 Hz sinusoid is generated. A DTMF detector attempts to detect

these frequiencies in the presence of noise and determines which button is presed [5]. Detection of frequiencies in noisy environment is a well studied area in a digital signal processing. The difficulty of DTMF tone detection is due to the standards which must be satisfied when these signals detected.

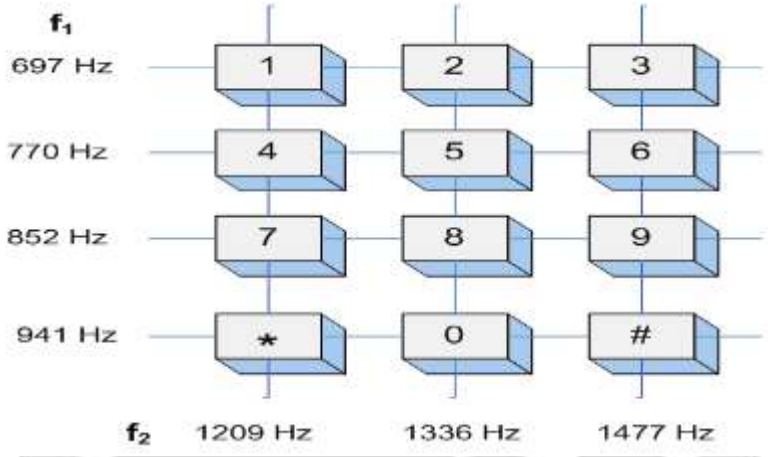

Fig-1. Phone keypad for DTMF generation

Fig- 1 shows mobile keypad frequencies associated with a particular key. Each of these tones is composed of two pure sine waves of the low and high frequencies superimposed on each other. These two frequencies explicitly represent one of the digits on the telephone keypad. Thus generated signal can be expressed mathematically as follows:

$$f(t) = AH \sin(2\pi fH\, t) + AL \sin(2\pi fL\, t) \quad (1)$$

Where AH, AL are the amplitudes & fH, fL are the frequencies of high & low frequency range. The summery of DTMF standards are given below:

1) Signal frequiencies:
   a) Low group (HZ) : 697, 770, 852, 941
   b) High group (HZ) : 1209, 1336, 1477, 1633
2) Frequiency Tolerences:
   a) Frequiencies with an offset less than ± 1.5% must be accepted.
   b) Frequiencies with an offset more than ± 3.5% must be rejected.
3) Signal Reception Timing:
   a) Tones with a duration less than 23 ms must be rejected.
   b) Tones with a duration more than 40 ms must be accepted.
   c) An interruption of more than 40 ms must be accepted as a pause (One tone has finished, a new tone has started).
   d) An interruption of less than 10 ms must be tolerated (The tone contineous)
4) Twist (Power difference between frequiencies):
   a) The low frequiency may have 8dB higher power.
   b) The high frequiency may have 4dB higher power.

3. BLOCK DIAGRAM

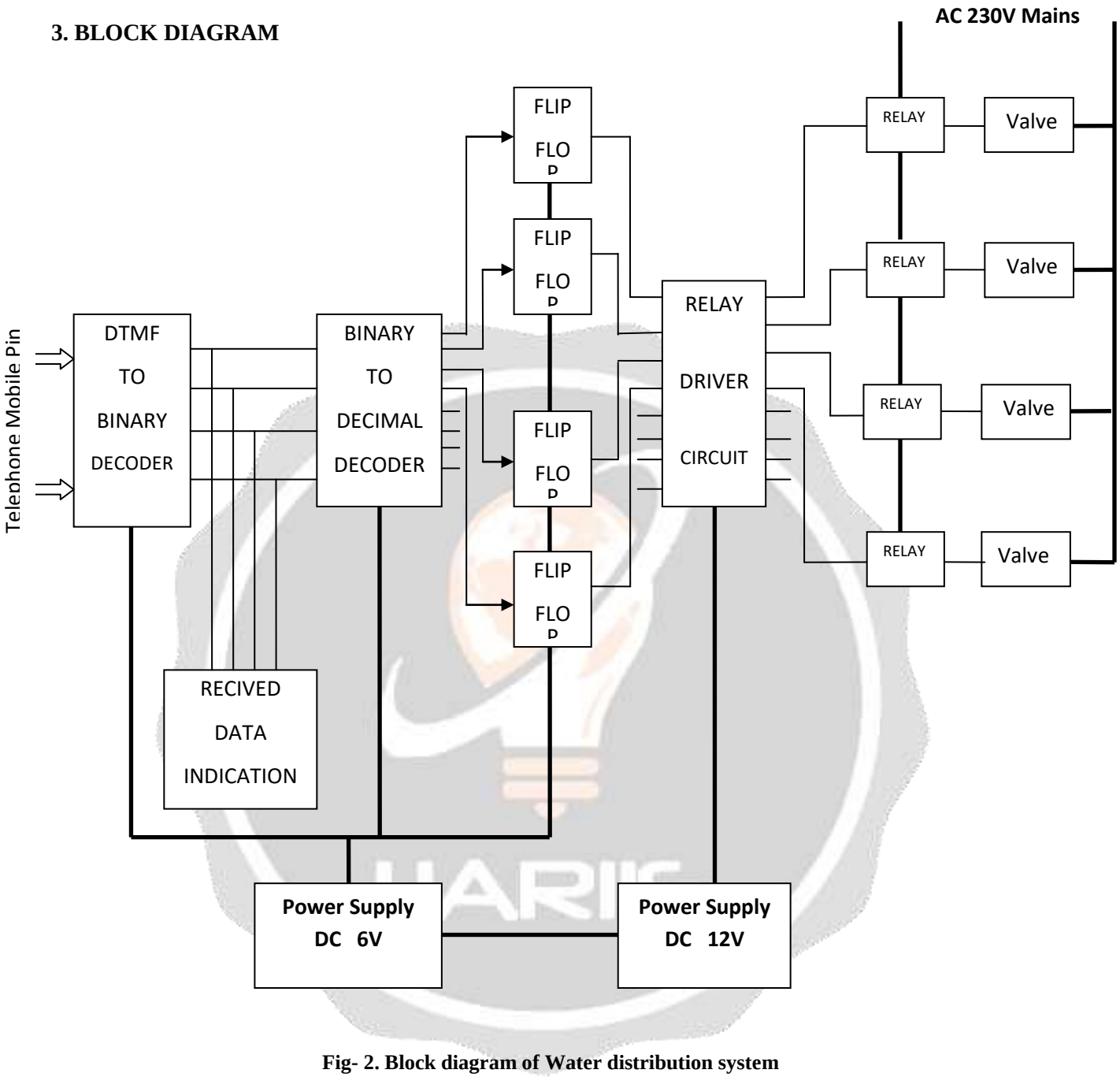

Fig- 2. Block diagram of Water distribution system

3.1 DTMF TO BINARY DECODER (IC MT8870):-

Here we can send dual tone multiple frequency signal by mobile or land line phone to decode the DTMF signal in to binary DTMF to binary decoder is used output of DTMF to binary decoder is 4 bit binary. Input of the circuit is connected to telephone jack or headset of mobile phone. DTMF keypads are employed in almost all landline & mobile handsets. Thus DTMF technology used in the telephone switching centers to identify the number dialed by the caller. A DTMF decoder distinguishes the DTMF tones & produces the binary sequence equivalent to the key pressed in DTMF keypad. The circuit uses M-8870 DTMF decoder IC which decodes tone generated by the keypad of cell phone. DTMF signal can tapped directly from the microphone pin of cell phone device. Cut the microphone wire and we get two wires 'Red'&'Green'. The red wire is the DTMF input to the circuit. The signals from the microphone wire are processed by the DTMF decoder IC which generates the equivalent binary sequence as parallel output as Q1, Q2, Q3 & Q4 [1, 2, 13].

Table-1. DTMF Frequency with Binary Codes

Button	Low DTMF frequency (Hz)	High DTMF frequency (Hz)	Binary coded output			
			Q1	Q2	Q3	Q4
1	697	1209	0	0	0	1
2	697	1336	0	0	1	0
3	697	1477	0	0	1	1
4	770	1209	0	1	0	0
5	770	1336	0	1	0	1
6	770	1477	0	1	1	0
7	852	1209	0	1	1	1
8	852	1336	1	0	0	0
9	852	1477	1	0	0	1
0	941	1336	1	0	1	0
*	941	1209	1	0	1	1
#	941	1477	1	1	0	0

3.2 RECEIVED DATA INDICATION:-

A light-emitting diode (LED) is a semiconductor device that emits visible light when an electric current passes through it. The light is not particularly bright, but in most LEDs it is monochromatic, occurring at a single wavelength.

3.3 BINARY TO DECIMAL DECODER (IC CD4028):-

To decode the binary data in to decimal, binary to decimal driver is used to obtain more and separate output for each binary number. Binary to decimal decoder can be 3 to8 line decoder or 4 to 10 line decoder and so on. We selected here 4 to 10 line decoder. The CD4028BC is a BCD-to-decimal or binary-to-octal decoder consisting of 4 inputs, decoding logic gates, and 10 output buffers. A BCD code applied to the 4 inputs, A, B, C, and D, results in a high level at the selected 1-of-10 decimal decoded outputs. Similarly, a 3-bit binary code applied to inputs A, B, and C is decoded in octal at outputs 0–7. A high level signal at the D input inhibits octal decoding and causes outputs 0–7 to go LOW. All inputs are protected against static discharge damage by diode clamps.

3.4 FLIP FLOP (IC CD4027):-

Now output of binary to decimal IC is given to flip-flop to control the 'ON' and 'OFF' status. In this circuit J-K flip-flop is used. Decimal decoder separates the binary data. Now it is given to flip flop to obtain flip flop (ON, OFF/ high, low) conditions depending upon clock pulse gives to the flip flop. One flip flop can control one relay driver section. If you have number of relay controls then number of flip flop should be connected [4].

3.5 RELAY DRIVER AND RELAY:-

Relay can be energies through the emitter follower transistor circuit or relay driver IC. In transistor circuit single transistor is used to drive one relay or relay driver single IC drives relay up to 8 at a time .Using more IC we can drive (energies) number of relays. A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long

distance telegraph circuits, repeating the signal coming in from one circuit and re-transmitting it to another. Relays were used extensively in telephone exchanges and early computers to perform logical operations. It is an electrically operated switch and is used to control a circuit by a low-power signal. A solid state relay is used in this project. It is a solid state electronic component that provides a similar function to an electromechanical relay but does not have any moving components, increasing long-term reliability [7, 10].

3.6 ELECTROMAGNETIC VALVE:-

Relay interface with 230 v AC main's and given to valve (valve is operate with 230 v AC) is of electromagnetic type. When AC 230V is provided by relay the valve is energies and. water flow starts. If relay deaneries (cuts 230 v AC) the valve de energies and water supply is stop.

4. WORKING

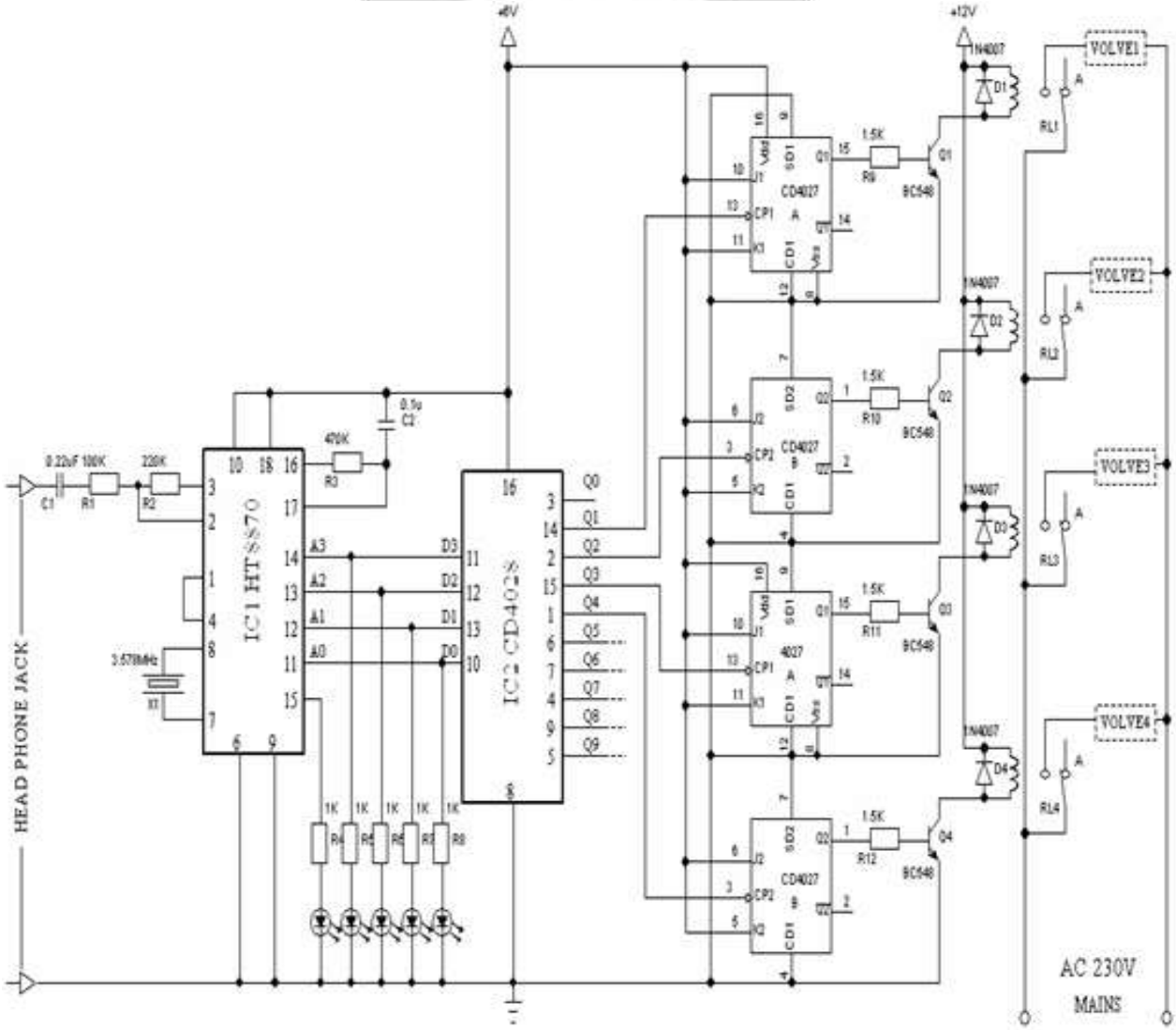

Fig-3 Circuit Diagram of Water distribution system

DTMF (dual tone multiple frequency) decoder is built around IC1 HT8870 (DTMF to binary decoder) this IC receives DTMF tone and convert it into binary equivalent output. Capacitor C1 is used to reduce noise input of DTMF signal resistor R1, R2 is used to proper amplification by internal amplifier. The input signal to IC1 is given by mobile headphone or land line phone jack. Resistor R3 and C2 used to control output response to the decoder IC1. Crystal (3.578 MHz) is used to provide oscillation to the circuit. Output of this IC is 4 bit binary depending on DTMF input signal. Output of IC1 given to LED's, for indication of binary numbers. LED's will glow depending on DTMF to binary received tone. Resistor R4 through R7 provides current limiting to the LED's. Similarly the output of IC1 is given to binary to decimal decoder .IC2 CD4028 this IC2 is 4to10 line decoder. Input of this IC is binary number and output is decimal pins. The output from Q0 through Q9 is high depending with input binary of this IC. Now we have maximum 10 outputs, from DTMF tone. Output of binary to decimal driver IC2 is given to flip flop to control the 'ON' and 'OFF' status. In this circuit we used J-K flip flop. J and K terminal is connected to Vcc (logic high) and set, reset is connected to ground (logic low). Now flip-flop output is 'high' for first clock input and 'low' for second clock pulse. The working of other flip flop is same. IC 3 to IC 6 is dual JK flip flop IC's. So for control 8 flip-flop action 4 IC/s required. All flip flop output Q is gives to relay driving section. The relay driving section builds around transistor as emitter follower or relay driver IC7 ULN2803. In ULN2803 IC 8 NOT gate buffer contains with freewheeling diodes. So other circuit does not require as emitter follower. If flip-flop one is set then it is connected to input of relay driver IC7. The output of IC7 goes lows and RELAY1 energies due to coil connection is placed between IC7 and 12V. Relay driver circuit requires 12v regulated DC supply. The relay is interface with AC 230V and connected with electromagnetic valve (This valve operate with 230 V AC) Now if relay energies AC 230v is supplied to valve and valve coil gets magnetized. Its piston gets pulled by coil (electromagnet) and water will flow in this valve. In this way depend on phone number / mobile number pressed, the valve 1 through valve 8 can be controlled, and we can provide water to 8 water lines. Total circuit requires 6V DC regulated supply and relay driving circuit requires 12V regulated DC supply. So we get supply from 12/0/12V center tapped, step down transformer. Output of transformer is AC so diode is used as rectifier, capacitor C3 is used to filter the ripples LM 7812 and LM7806 is used to get regulated 12V and 6V supply respectively.

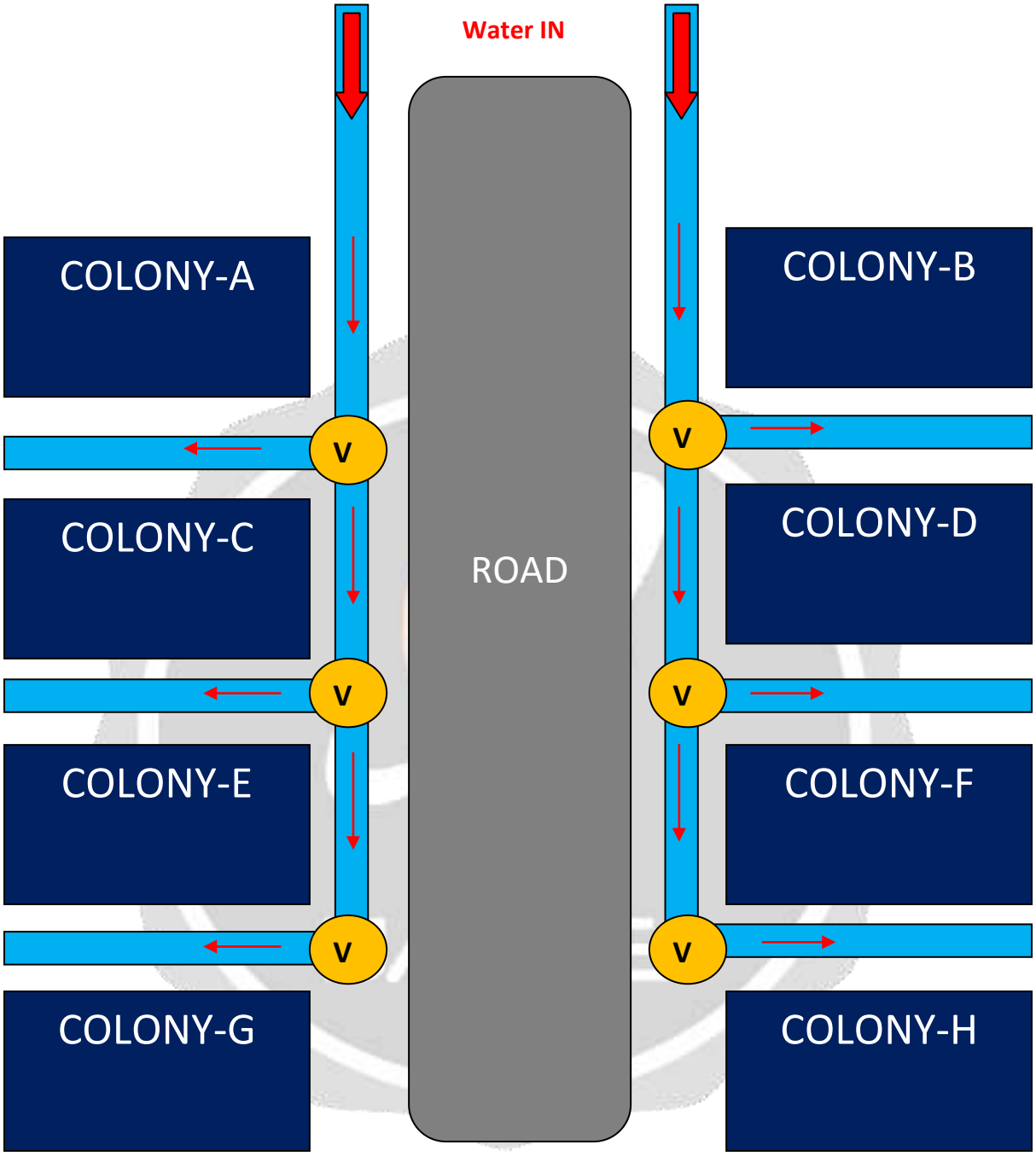

Fig- 4 Actual implementation plan

5. CONCLUSION

In this paper we propose a unique system for automatic water control in municipal sector utilizing Dual Tone Multi Frequency technology. This system is Automatic so it reduces lots of water wastage and man power. We can on or off water supply from anywhere at any time.

6. REFERENCES

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