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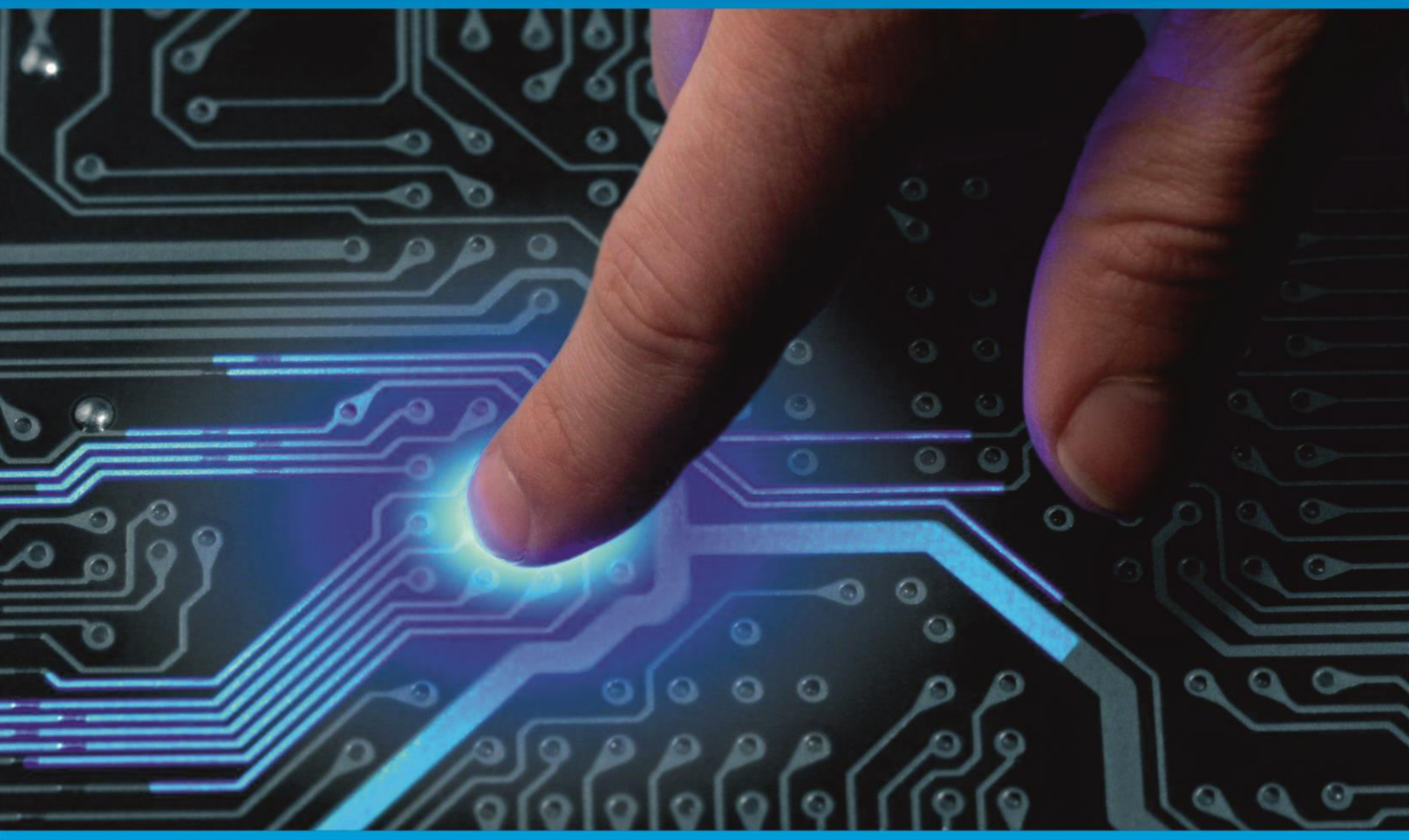

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Automated Water Distribution & Metering for Apartments

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ABSTRACT: One of the major untold or not outspoken problems in apartments is Water Consumption. Questions arise like: Who spends more? What if there is no water in the tank when in need? and much more. Our motto is to introduce a device in the market which does both Water Metering (Consumption) and also to automate Water Distribution in Apartments using Embedded network. Our end product will be a cost effective and highly reliable Water System for apartments providing How much water each apartment consumes? and the Water levels. Hence ensuring the Customer doesn't panic when there is no water, instead he'll be getting a reminder early. Urban water system is a multipurpose and integrated system Considering INDIA'S economic and social development requirement, there are many rigorous problems in exploitation, utilization, operation and management of urban water resources comparing with some developed cities in the world. A number of cities, especially small and medium-sized cities, are on the serious condition of water shortage and water wasting in INDIA. It is an important means for development of economy and society to achieve the sustainable utilization of water resources. Building a sustainable management and development system for urban water resources and water environment has conclusive sense for supporting the urban economic and social development. Moreover, it analyzes the function of regulation and control of sustainable urban water management in houses.

KEYWORDS: Water Distribution, IoT, Embedded System, GSM, Water Consumption, Sump Level, Overhead Tank & Auto Switching.

I. INTRODUCTION

An embedded system can be a small independent system or a large combinational system. It is a microcontroller-based control system used to perform a specific task of operation.

1.1 EMBEDDED SYSTEMS:

Before An embedded system is a combination of three major components:

Hardware: Hardware is physically used component that is physically connected with an embedded system. It comprises of microcontroller based integrated circuit, power supply, LCD display etc.

Application software: Application software allows the user to perform varieties of application to be run on an embedded system by changing the code installed in an embedded system.

Real Time Operating system (RTOS): RTOS supervises the way an embedded system work. It acts as an interface between hardware and application software which supervises the application software and provide mechanism to let the processor run on the basis of scheduling for controlling the effect of latencies.

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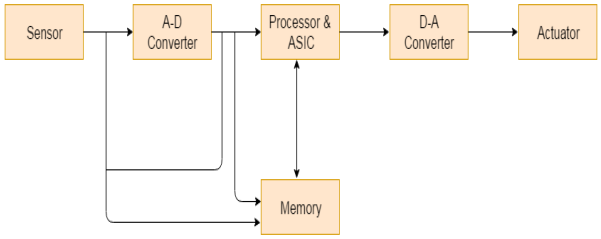

FIG A : Basic Block Diagram of Embedded System

II. EXISTING SYSTEM

Existing way of water system implementation includes water meters for each apartment which calculates billing for amount of water consumption for each apartment only. It regularly monitors water consumption only, and implementation cost would be high as it includes Property Manager to maintain the system and monitor regularly.

For Smaller Apartments, high implementation cost is not required. Hence not applicable. Requires WIFI network and maintenance and fault finding becomes difficult in this system.

III. PROPOSED SYSTEM

Distribution of water is automated by the use of Arduino which acts as the brain of the system. Ultrasonic sensors and Flow Sensors are measuring sensors which sends the data to Arduino which processes it and switches 'On'& 'Off' by use of relay.

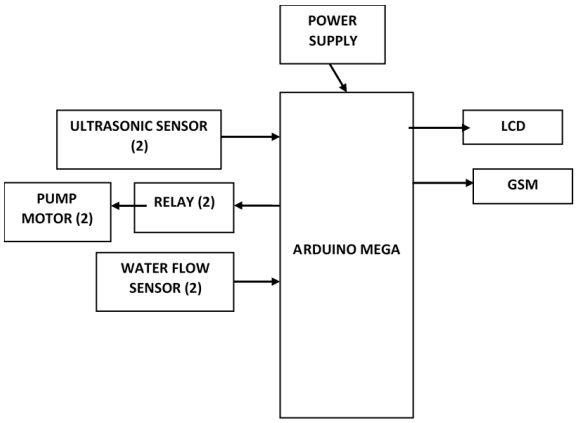

FIG B: Block Diagram of the Proposed System

SCENARIO 1 (No Water in Tank, Sump is full)

When Over Head tank is empty, which is known by use of ultrasonic sensor which regularly monitors the water level of tank and triggers the process of filling. When the water level of the overhead tank reaches to a 15-20% of the tank, a trigger is sent to Arduino which first checks if the Sump Level is above 15% of the Tank to refill.

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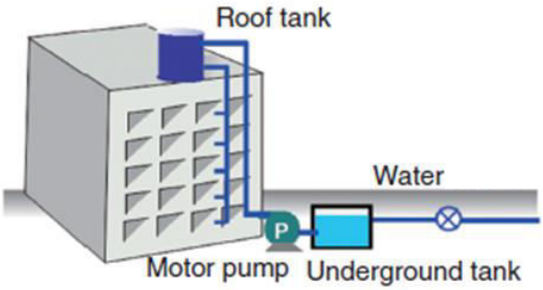

FIG C: Tank Empty & Sump is full

Once Arduino acknowledges that Sump is not empty, the motor starts automatically by use of Relay, and tank starts filling up. When water level reaches 95% the motor automatically stops the process to avoid overflow. Hence the cycle is complete & the sensors continue to monitor the levels. All the filling and water levels are displayed on the LCD Display.

Each flat in the Apartment are fitted with Flow Rate Sensors which regularly monitors the amount of water consumed by each flat. Hence, they'll pay only for the amount of water they use.

SCENARIO 2 (Sump water getting empty)

When Over Head Tank is empty, the motor switches 'On' after checking the water level of sump. At the time of filling the sump water level will go down and Roof Tank's level goes up.

When the sump water level goes below threshold level i.e., below 15% of the Sump, the filling process automatically stops and an SMS alert is sent to the Head of Apartment.

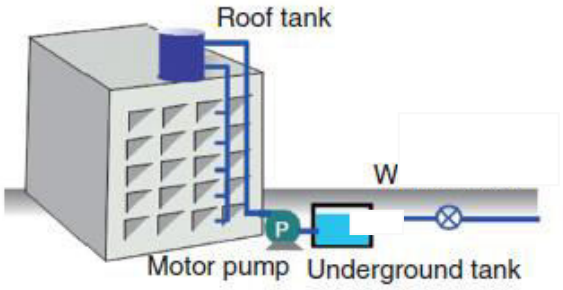

FIG D: Sump getting Empty

Hence, they can call up local water distributor for refilling of sump. At this point of time, they can check the amount of water consumed by each flat and divide the cost by looking at the LCD Display. When the sump is getting automatically overhead tank is also filled by the process.

To avoid overflow of the roof tank, while filling when the water level reaches 95% the motor is automatically switched off, and hence the process is complete & the sensors continue to monitor the levels. All the filling and water levels are displayed on the LCD Display.

IV. HARDWARE REQUIREMENTS

ARDUINO MEGA: The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

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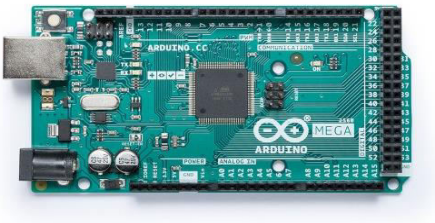

FIG F: Arduino Mega 2560

ULTRASONIC SENSORS: Ultrasonic Detection is most commonly used in industrial applications to detect hidden tracks, discontinuities in metals, composites, plastics, ceramics, and for water level detection. For this purpose, the laws of physics which are indicating the propagation of sound waves through solid materials have been used since ultrasonic sensors using sound instead of light for detection.

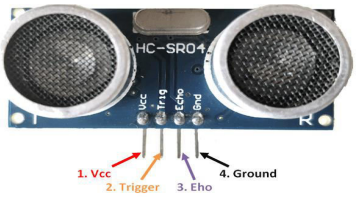

FIG G: Ultrasonic Sensor

An Ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves.

FLOW RATE SENSOR: Water flow sensor consists of a plastic valve body, a water rotor, and a hall-effect sensor. When water flows through the rotor, rotor rolls. Its speed changes with different rate of flow.

FIG H: Flow Rate Sensor

The hall-effect sensor outputs the corresponding pulse signal. The provided sensors are well-manufactured from the topmost grade components and the latest technology under the supervision of our dexterous professionals.

LIQUID CRYSTAL DISPLAY: LCD screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits.

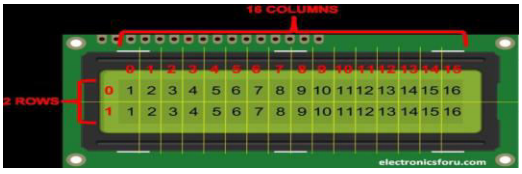

FIG I: LCD Display

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These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlikeinseven segments), animations and so on.

RELAYS: Relays are the primary protection as well as switching devices in most of the control processes or equipment. All the relays respond to one or more electrical quantities like voltage or current such that they open or close the contacts or circuits.

FIG J: Relays

Protective relays continuously monitor these parameters: voltage, current, and power; and if these parameters violate from set limits, they generate alarm or isolate that particular circuit. These types of relays are used to protect equipment like motors, generators, and transformers, and so on.

SIM 900 GSM/GPRS MODULE: Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz It is estimated that many countries outside of Europe will join the GSM partnership.

FIG K: GSM Module

PUMP MOTOR: A pump motor is a DC motor device that moves fluids. A DC motor converts direct current electrical power into mechanical power. DC or direct current motor works on the principal, when a current carrying conductor is placed in a magnetic field; it experiences a torque and has a tendency to move. This is known as motoring action.

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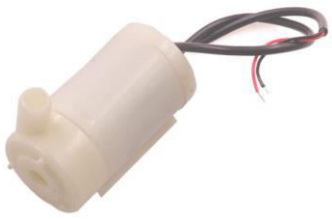

FIG L: Pump Motor

V. SOFTWARE REQUIREMENTS

ARDUINO IDE: Arduino integrated development environment (IDE), also known as the Arduino development environment, is a program designed to make it easier to write software for this open-source platform. IDEs are commonly used by programmers to speed up the process of programming. Common IDE features include automatic line numbering, syntax highlighting, and integrated compiling. While it is technically possible to write to software using only a simple text editor, the process is much easier when writing code in an IDE. Many programming languages have their own IDEs, and several general-purpose IDES have been developed. These general-purpose IDEs can be used with a variety of supported programming languages.

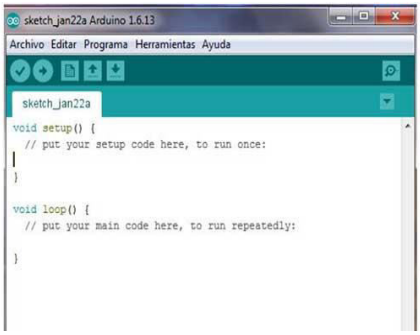

FIG M: Arduino IDE

The Arduino IDE is a Cross platform Java Application that serves as a code editor and compiler and is also capable of transferring firmware serially to the board. The main benefits of Arduino IDE can be seen in its ability to function as an on-premise application and as an online editor, direct sketching, board module options, and integrated libraries.

EMBEDDED C: Embedded C is most popular programming language in software field for developing electronic gadgets. Each processor used in electronic system is associated with embedded software.
Embedded C programming plays a key role in performing specific function by the processor.

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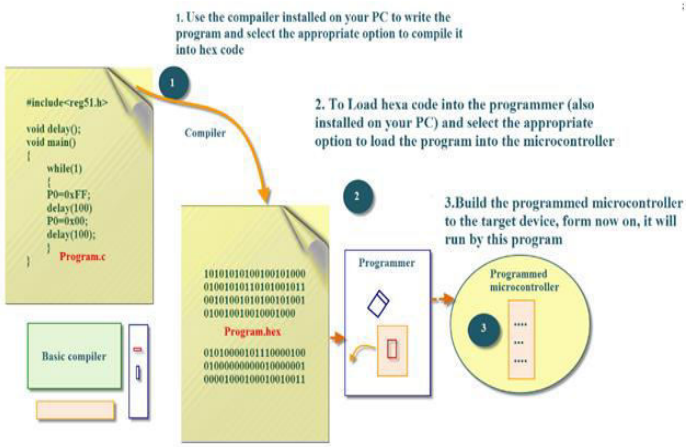

FIG N: Embedded C Flow

VI. ADVANTAGES

- The complete automation of water management and distribution system for apartments.
- To reduce the water consumption by providing the amount of water used to the consumer.
- Regular monitoring of water levels and timely alerts to the consumers to call out for Water Distributor.
- Low budget, highly scalable network, hence ensuring the network can be easily updated.

VII. RESULT

By this system, by use ARDUINO MEGA (ATmega2560) and Sensors to monitor the Water levels. Automation of water distribution and metering is achieved.

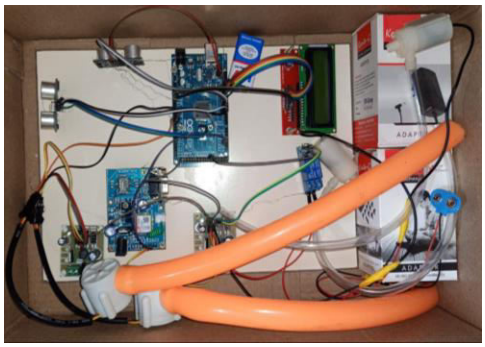

FIG O: Proposed System

Here we have two ultrasonic sensors to know the level of water in the tanks. The empty status of water is update to the respective person using GSM. As well we use pump motor to fill the tank automatically. Using water flow sensor going to measure the water flow to the house and display in the LCD.

VIII. CONCLUSIONS

By studying this project along with the existing system, we can conclude that this project helps as an effective way to monitor the water levels remotely for a smaller apartment. Provide them with timely alerts on water levels ensuring they don't panic at the time of water scarcity.

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IX. FUTURE SCOPE

- To automate the billing of water consumption via SMS.
- To Upgrade the microcontroller to more reliable source & to increase range of application.
- Regular monitoring of water levels and timely automatic alerts to the consumers & a SMS to Water Distributor.
- To be highly scalable network, by use of FPGA on later upgrades.
- Android based application for real time monitoring of water levels.

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