GOVERNMENT POLYTECHNIC, PUNE-16

(**An Autonomous Institute of Government of Maharashtra**)

Department of Computer Engineering

Academic Year (2019-2020)

A Project Report On

Smart Water Tank Controller

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Under The Guidance Of

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GOVERNMENT POLYTECHNIC, PUNE-16

(An Autonomous Institute of Government of Maharashtra)

CERTIFICATE

This is to certify that

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of class Third Year (2019-2020) has successfully completed project on the Smart Water Tank Controller System under the guidance of **Smt. A.M Galshetwar** in partial fulfilment of the requirement for the award of diploma in Computer Engineering from Government Polytechnic, Pune.

Smt. A.M Galshetwar **Mr.U.V.Kokate**

(Project Guide) (Head of Department)

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Acknowledgement

We are thankful for providing such an exciting way of developing our knowledge regarding the project development. We take a great pleasure in presenting the report for our project “Smart Water Tank Controller System”. We come to know project development and its overall aspects through this project.

First and foremost, we would like to express our deepest sense of gratitude and sincere thanks to our Project guide Smt. A.M Galshetwar for their timely co-operation, eminent guidance and lots of encouragement. In a particular, we wish to offer our gratitude to honourable Head of Computer Engineering Department MR. U.V. KOKATE.

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Abstract

SWC is a small device used to control the flow of water tank in a smart way. It not only controls the overflow but also saves motor pump to prevent it from running dry. SWC is a minimalistic device which automatically switches off motor pump when the tank becomes full, and sends a sms to the owner as an acknowledgement.

This was a basic concept implemented but SWC also consist of doing this in more smart way. It can direct the flow to a single tank which is connected in series to a single motor pump because when tanks are connected in series, by just switching off the motor pump will even close the flow of the remaining tanks .Hence which can result the tanks to remain unfilled. SWC consist Arduino as the main controller which works parallel with the SMC and motor relay controller for the smart functioning. It also consist of a LCD 16x2 displays which indicates the current water level present in tank. It consists of the sonar sensor which helps the Arduino to measure the actual level. Talking about its durability SWC is Dust proof and Water proof.

1. Introduction

In everyday life, there must be some physical elements that need to be controlled in order for them to perform their expected behaviours. A control system therefore can be defined as a device, or set of devices, that manages, commands, directs or regulates the behavior of other device(s) or system(s). Consequently, automatic controlling involves designing a control system to function with minimal or no human interference. Intelligent systems are being used in a wide range of fields including from medical sciences to financial sciences, education, law, and so on. Several of them are embedded in the design of everyday devices.

This report aimed at presenting our project in embedding a control system into an automatic water controller. One of the motivations for this research was the need to bring a solution to the problem of water shortage in various places eliminating the major culprit; waste of water during pumping and dispensing into overhead thanks. We believe that creating a barrier to wastage will not only provide more financial gains and energy saving, but will also help the environment and water cycle which in turn ensures that we save water for our future.

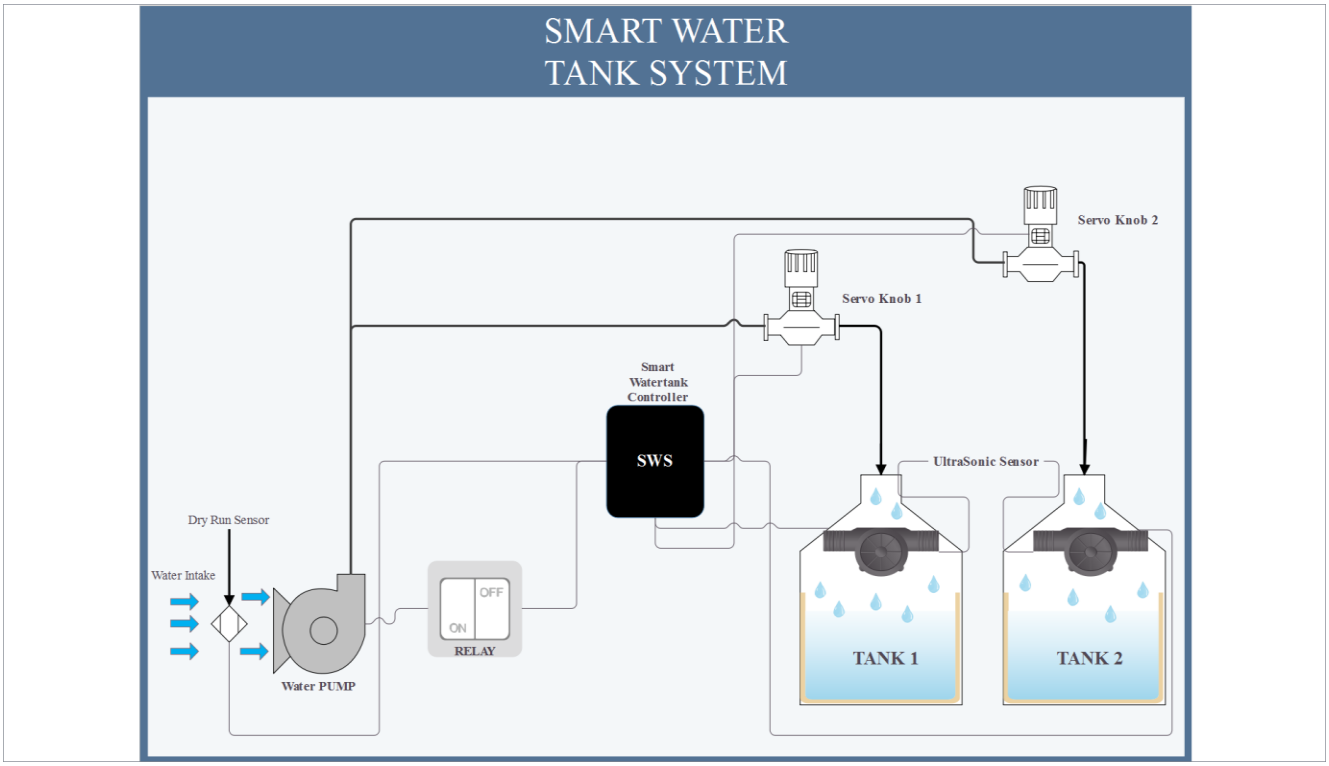

Fig No. 1.1 Overview of SWS

2. Project Plans

2.1 Background and Purpose

Traditionally in most of the areas people manually control the motor for water storage by switching on and off as per the filled water tanks.

Water scarcity and water wastage is an increasing problem in a country like India. In this project we have tried to provide an aid to this problem. Embedded systems are now-a-days playing a vital role in Engineering design process for efficient analysis and effective operation. Due to time complexity in electronic aspects embedded systems have become a major part of our daily life. So therefore, with the help of embedded systems we have designed a project which can measure the water level of a storage tank. This not only provides us with the required information about the status of the water tank but also helps and reduces the manpower required in this whole process. Our project is a contribution towards the solution for water scarcity problems. Also, the application of embedded systems reduces the probability of error caused by human intervention

2.2 Goal

The goal is to improve the way in which we live, to make our lives easier by reducing manual work and reduce water scarcity problem. It is important because with the world population rising minute by minute, the need for water is increasing and therefore water conservation is the need of the hour.

2.3 Restrictions

- To monitor the tank consumer needs to buy both Ultra Sonic Sensor and Servo Valve.

2.4 Technologies and tools

Arduino

Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices. Its products are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form or as do-it-yourself (DIY) kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards ('shields') or breadboards (For prototyping) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers can be programmed using C and C++ programming languages. In addition to using traditional compiler tool chains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

Arduino Features

- It is inexpensive
- It comes with an open source hardware feature which enables users to develop their own kit using already available one as a reference source.
- The Arduino software is compatible with all types of operating systems like Windows, Linux, and Macintosh etc.
- It also comes with open source software feature which enables experienced software developers to use the Arduino code to merge with the existing programming language libraries and can be extended and modified.
- It is easy to use for beginners.
- We can develop an Arduino based project which can be completely stand alone or projects which involve direct communication with the software loaded in the computer.

- It comes with an easy provision of connecting with the CPU of the computer using serial communication over USB as it contains built in power and reset circuitry.

Arduino Architecture

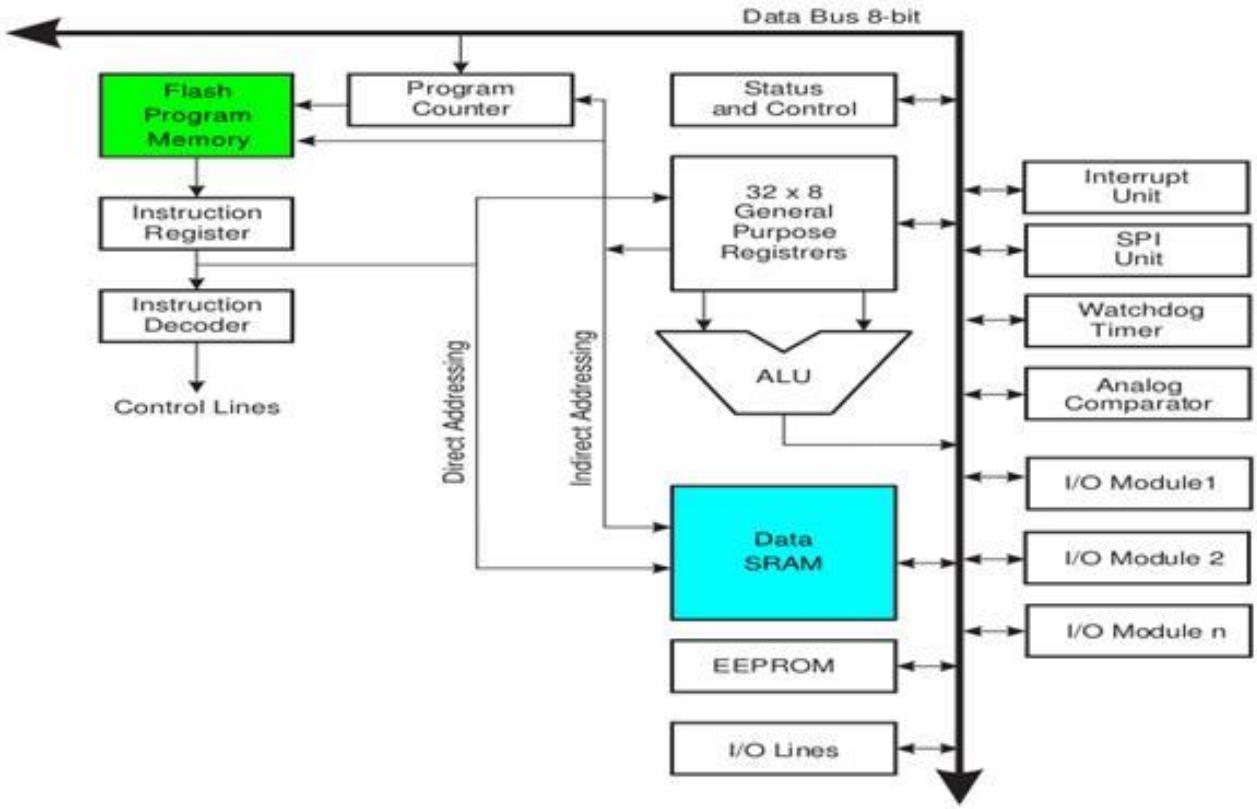

Fig No 2.4.1 Arduino Architecture

Few of basic Arduino functions are:

- **digitalRead(pin):** Reads the digital value at the given pin.
- **digitalRead(pin, value):** Writes the digital value to the given pin.
- **pinMode(pin, mode):** Sets the pin to input or output mode.
- **analogRead(pin):** Reads and returns the value.

- **analogWrite(pin, value):** Writes the value to that pin.

- **serial.begin(baud rate):** Sets the beginning of serial communication by setting the bit rate.

2.5 Project Code

Whole code is performed in Arduino. As it is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices.

2.6 Methodology

It is essential that any programmer must thoroughly know the language he or she uses when designing and analyzing. The programmer would have to analyze the program and then knows the problem he needs to solve. He would then perform the process of coding while applying the process of design which he presented previously. Finally, he or she would have to test the program in order to ascertain compatibility with customer requirement.

The process we have mentioned, including Analysis, Design, Coding and Testing, identify the project's development as any project would have to go through all these processes using the appropriate methodology. Otherwise, chaos would ensue. We shall use the Interactive and incremental development methodology in order to develop a prototype system.

This process is characterized with flexibility and revision whenever necessary in all phases. The process would begin with an initial plan and concluded with interaction among the various phases and components.

3. Project Requirements

1) Arduino Nano R3

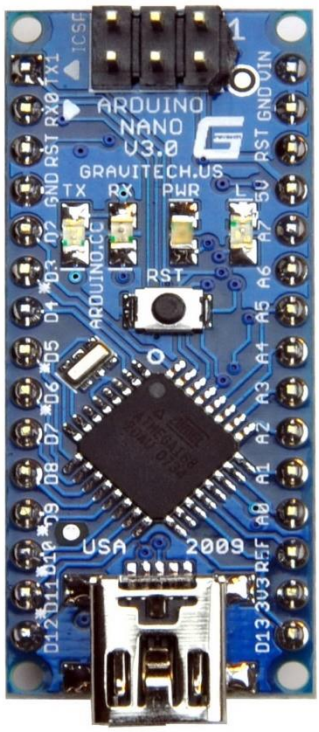

Fig No. 3.1.1 Arduino Nano R3

Arduino Nano is a surface mount breadboard embedded version with integrated USB. It is a smallest, complete, and breadboard friendly. It has everything that Diecimila/Duemilanove has (electrically) with more analog input pins and onboard +5V AREF jumper. Physically, it is missing power jack. The Nano is automatically sense and switch to the higher potential source of power.

Nano's got the breadboard-ability of the arduino and the Mini+USB with smaller footprint than either, so users have more breadboard space. It's got a pin layout that works well with the Mini or the Basic Stamp (TX, RX, ATN, GND on one top, power and ground on the other). This new version 3.0 comes with ATMEGA328 which offer more programming and data memory space. It is two layers. That make it easier to hack and more affordable.

Specifications:

- Microcontroller - ATmega328
- Operating Voltage - 5 V
- Flash Memory - 32 KB (2 KB used by bootloader)
- SRAM - 2 KB
- Clock Speed -16 MHz
- Analog IN Pins – 8
- Input Voltage - 7 to 12 V
- PWM Output – 6
- Power Consumption - 19 mA
- PCB Size - 18 x 45 mm
- Weight - 7 grams

Features:

- Operating voltage is 5V
- Input voltage (Vin) is 7V to 12V
- Input/Output Pins are 22
- Analog i/p pins are 6 from A0 to A5
- Digital pins are 14
- Power consumption is 19 mA

- I/O pins DC Current is 40 mA
- Flash memory is 32 KB
- SRAM is 2 KB
- EEPROM is 1 KB
- CLK speed is 16 MHz
- Weight-7g
- Size of the printed circuit board is 18 X 45mm
- Supports three communications like SPI, IIC, & USART

2) Relay Module

Fig No. 3.2.1 Relay Module

The relay module is an electrically operated switch that allows you to turn on or off a circuit using voltage and/or current much higher than a microcontroller could handle. There is no connection between the low voltage circuit operated by the microcontroller and the high power circuit. The relay protects each circuit from each other. The each channel in the module has three connections named NC, COM, and NO. Depending on the input signal trigger mode, the jumper cap can be placed at high level effective mode which 'closes' the normally open (NO) switch at high level input and at low level effective mode which operates the same but at low level input.

Specification:

- Digital output controllable.
- Compatible with any 5V microcontroller such as Adriano.
- Rated through-current: 10A (NO) 5A (NC)
- Control signal: TTL level.
- Max. switching voltage 250VAC/30VDC.
- Max. switching current 10A.

3) 9g Micro Servo

Fig No 3.3.1 9g Micro Servo

Tiny and lightweight with high output power. Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. You can use any servo code, hardware or library to control these servos

Features

- Operating Voltage is +5V typically
- Torque: 2.5kg/cm
- Operating speed is 0.1s/60°
- Gear Type: Plastic
- Rotation : 0°-180°
- Weight of motor : 9gm

4) LCD 16 X 2

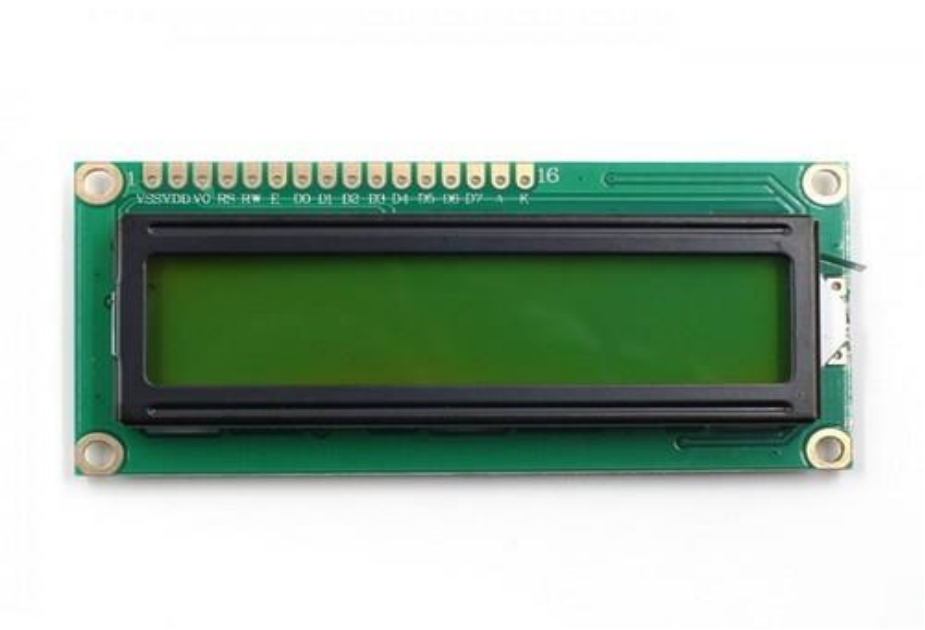

Fig No 3.4.1 LCD 16X2

An LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in DIYs and circuits. The 16×2 translates a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5×7 pixel matrix.

Features

- Operating Voltage is 4.7V to 5.3V
- Current consumption is 1mA without backlight
- Alphanumeric LCD display module, meaning can display alphabets and numbers
- Consists of two rows and each row can print 16 characters.
- Each character is built by a 5×8 pixel box
- Can work on both 8-bit and 4-bit mode
- It can also display any custom generated characters

5) 220 Ohm Resistor

Fig 3.5.1 220 Ohm Resistor

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Carbon film resistors are a fixed form type resistor. They are constructed out of a ceramic carrier with a thin pure carbon film around it that functions as restive material. Resistors act to reduce current flow, and, at the same time, act to lower voltage levels within circuits. In electronic circuits, resistors are used to limit current flow, to adjust signal levels bias active elements, and terminate transmission lines among other uses.

Specification:

- Resistance: 220Ω
- Film: Carbon Film
- Tolerance: 5%
- Power rating: 1/4Watt

6) Rotary Potentiometer- 10k Ohm, Linear

Fig No 3.6.1 Rotary Potentiometer / Linear

This is a center-tap linear type potentiometer. The outer two pins will always show 10K resistance, the center pin resistance to one of the outer pins will vary from 10K Ohm to about 50 Ohm. The pot is linear meaning the resistance will vary linearly with its position. This is a good choice for general user interfaces.

Specifications

- 10K ohm potentiometer, linear taper
- 100,000 Cycle Life
- 16mm Body
- Rotational travel: 300 °
- Static Stop Strength: 90 oz-in
- Rotational Torque: 0.5 to 1.25 oz-in

7) Submersible Pool Water Pump

Fig No 3.7.1 Water Pump

A submersible pump, also called an electric submersible pump, is a pump that can be fully submerged in water. The motor is hermetically sealed and close-coupled to the body of the pump.

A submersible pump pushes water to the surface by converting rotary energy into kinetic energy into pressure energy. This is done by the water being pulled into the pump: first in the intake, where the rotation of the impeller pushes the water through the diffuser. From there, it goes to the surface.

The major advantage to a submersible pump is that it never has to be primed, because it is already submerged in the fluid. Submersible pumps are also very efficient because they don't really have to spend a lot of energy moving water into the pump. Water pressure pushes the water into a submersible pump, thus "saving" a lot of the pump's energy.

8) 10k Ohm Resistor

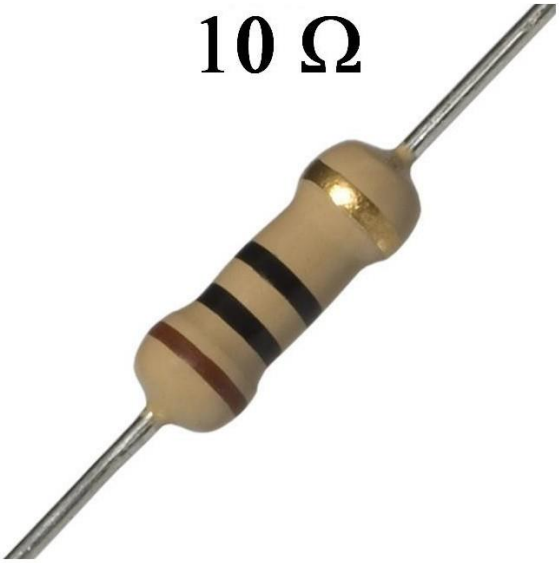

Fig No 3.8.1 10k Ohm resistor

Resistor 10k Ohm 1/6th Watt PTH. 1/6th Watt, +/- 5% tolerance PTH resistors. Commonly used in PCBs and perf boards, these 10K resistors make excellent pull-ups, pull-downs, and current limiters.

9) QuadBand GPRs- GSM SIM 800L

Fig No 3.9.1 Quadband GPRs GSM SIM 800 L

The SIM800L module is a complete Quad-band GSM/GPRS solution in a LGA type which can be embedded in the customer it has a set of TTL level serial interface, a set of power supply interface. Besides, there are a set of antenna interface on this module.

Features

- Supply voltage range 3.4 ~ 4.4V and
- Current of 1A or more(the current is very important)
- It features Bluetooth, FM and Embedded AT(AT commands)
- Quad-band 850/900/1800/1900MHz
- Operation temperature:-40 ~85 degree Celsius

Applications:

- SIM800L support Quad-band 850/900/1800/1900MHz, it can transmit Voice, SMS and data information with low power
- Due to its size it can fit into slim and compact demands of customer design.

10) Ultrasonic Sensor HC-SR04

Fig No 3.10.1 Ultrasonic Sensor

The HC-SR04 Ultrasonic Distance Sensor is a sensor used for detecting the distance to an object using sonar.

The HC-SR04 uses non-contact ultrasound sonar to measure the distance to an object, and consists of two ultrasonic transmitters (basically speakers), a receiver, and a control circuit. The transmitters emit a high frequency ultrasonic sound, which bounce off any nearby solid objects, and the receiver listens for any return echo. That echo is then processed by the control circuit to calculate the time difference between the signal being transmitted and received. This time can subsequently be used, along with some clever math, to calculate the distance between the sensor and the reflecting object!

Features:

- Input Voltage: 5V
- Current Draw: 20mA (Max)
- Digital Output: 5V
- Digital Output: 0V (Low)
- Working Temperature: -15°C to 70°C
- Sensing Angle: 30° Cone
- Angle of Effect: 15° Cone
- Ultrasonic Frequency: 40kHz
- Range: 2cm - 400cm

11) Female DC power adapter - 2.1mm jack

Fig No 3.11.1 Female DC power supply

There is a 2.1mm DC jack on one end, and a screw terminal block on the other. The terminals are labeled with positive/negative assuming a positive-tip configuration. This DC Jack adapter is very useful while using breadboard and we need to provide supply to breadboard using DC Adapter.

12) Voltage Regulator 3.3V

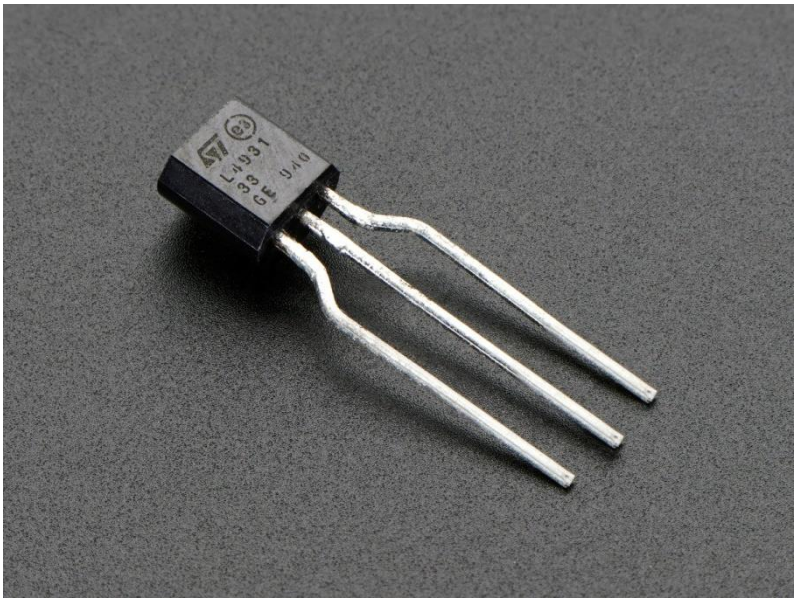

Fig No 3.12.1 Voltage Regulator

This regulator is often used to get a 5V power supply to clean 3.3V. There is a constant 'quiescent' current draw of 5mA. This regulator can provide up to 800 mA as long as it has proper heat-sinking. The higher your input voltage and output current, the more heat it will generate.

13) Ceramic Capacitor 1000F

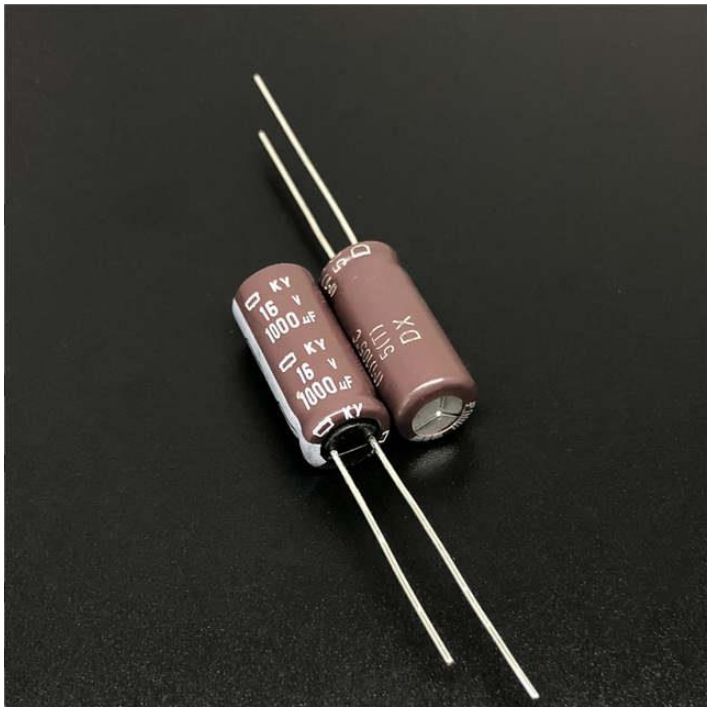

Fig No 3.13.1 Ceramic Capacitor

Ceramic capacitor is made up of ceramic material which acts as a dielectric material for it. Ceramic capacitors are available in small values such as in micro, milli, nano, pico farads.

Capacitors store energy in the dielectric, NOT in the conductive plates. Only two things determine a capacitor's effectiveness: its physical dimensions (plate area and distance separating them), and the dielectric constant of the insulating between the plates. More area means a bigger field, closer plates mean a stronger field (since field strength is measured in Volts per meter, so the same difference of potential across a much smaller distance yields a stronger electric field).

The dielectric constant is how strong a field will be generated in a specific medium. Ceramic capacitors are able to store small energy.

14) Electrolytic Decoupling Capacitors - 10uF/25V

Fig No 3.14.1 Electrolytic Decoupling Capacitor

Low-profile electrolytic decoupling capacitors 10uF/25V. These capacitors are great transient/surge suppressors and work well as charge pump caps for MAX232 circuits. High quality radial electrolytic capacitors.

15) Bread Board

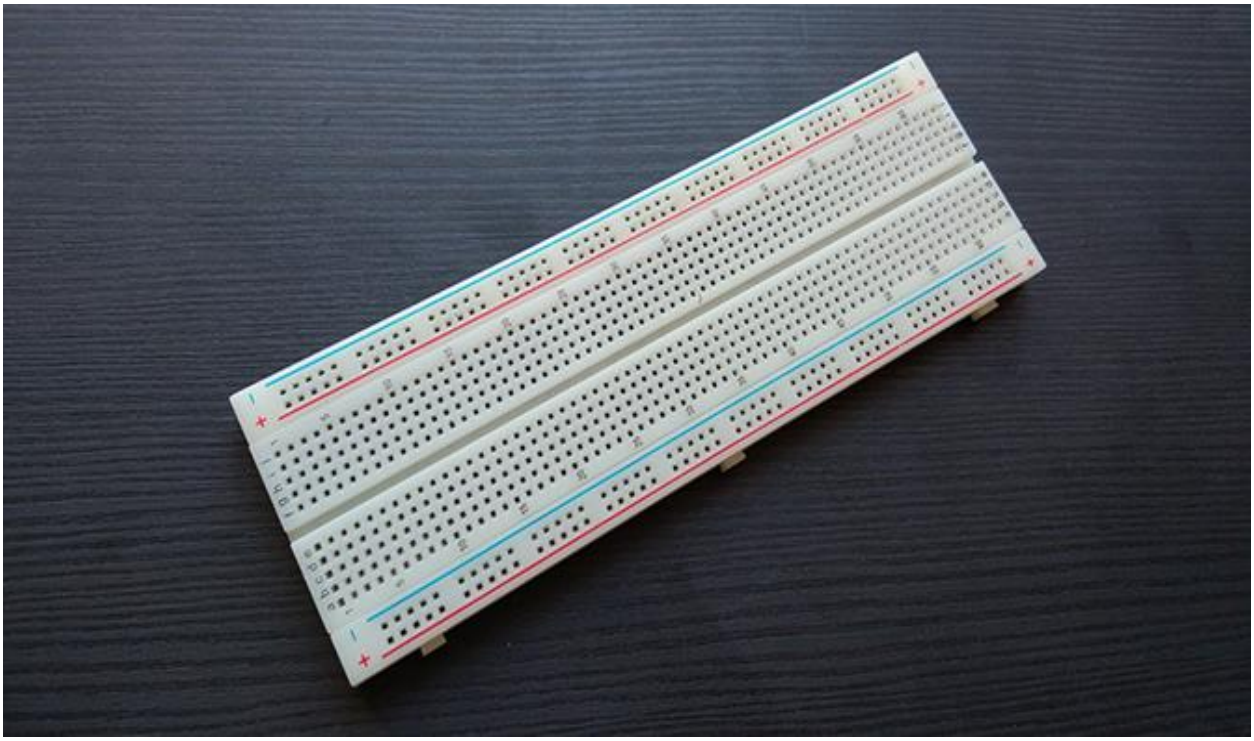

Fig No 3.15.1 Bread Board

A breadboard is a construction base for prototyping of electronics. Originally the word referred to a literal bread board, a polished piece of wood used for slicing bread. In the 1970s the solderless breadboard (a.k.a. plugboard, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these.

Because the solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solderless breadboards are also popular with students and in technological education. Older breadboard types did not have this property.

A stripboard (Veroboard) and similar prototyping printed circuit boards, which are used to build semi-permanent soldered prototypes or one-offs, cannot easily be reused. A variety of electronic systems may be prototyped by using breadboards, from small analog and digital circuits to complete central processing units (CPUs)

16) Jumper Wires

Fig No 3.16.1 Jumper Wires

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed. Fairly simple. In fact, it doesn't get much more basic than jumper wires.

What Do the Colors Mean?

Though jumper wires come in a variety of colors, the colors don't actually mean anything. This means that a red jumper wire is technically the same as a black one. But the colors can be used to your advantage in order to differentiate between types of connections, such as ground or power.

17) Male Headers

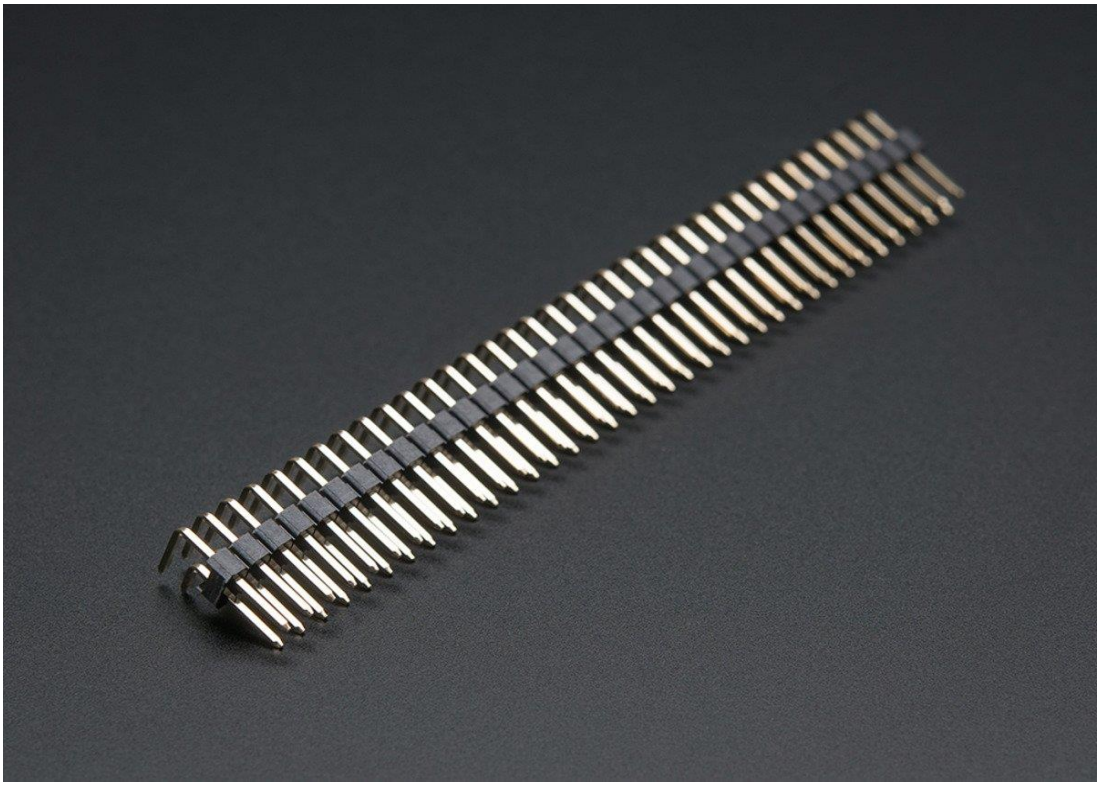

Fig No 3.17.1 Male Header

Pin headers are often associated with ribbon cable connectors, pin headers often also function as recipients for jumpers. The most common jumper spacing is 2.54 millimetres (0.1 in), though 2.0 millimetres (0.079 in) is sometimes used in smaller products.

Pin header connectors are thus "male" connectors and are mostly used inside equipment, rather than being used as a connector on the outside of the device.[2]

Normally pin headers are pin through hole (PTH) devices, but surface-mount technology (SMT) versions of one and two row pin headers also exist. In the latter case the solder sides of the pins are simply bent on a 90 degree angle so as to be soldered to a solder plane. On single row pin headers the pins are bent alternating to one side or the other, on dual row pin headers the pins are simply bent outwards. If pin headers are optional, the PTH variant is often chosen for ease of manual assembly. Pin headers can be either *straight* or *angled*. The latter form is often used to connect two boards together.

3.1 User Requirement

The system should have a number of facilities. According to the Consumer Requirements the system is built in the way that it provides the number of facilities to the users and administrators.

The user may require the followings:

1. Correctness:

Correctness is the degree to which the software performs its required function. The extent to which the software satisfies its specifications and fulfills the customer's mission objectives.

This system adapts the degree of Correctness by achieving the facilities and the User requirements. The software is correct in all the manner because the testing is done in each unit of the system. Thus, we can say that our system to be correct system as it meets all the requirements of the users.

2. Performance:

The main motto of the degree of performance is that the developed system should perform all the tasks the user has specified.

3. User Friendly:

The developed system is user friendly by which the user can understand the system easily. It provides a good interface thus it is said to be user friendly.

4. Maintenance:

The user wants that the system must be maintained properly before accepting the system. Thus, the software provides the maintenance to the users. System needs to be maintained not because some of its components wear out and need to be replaced, but because there are often same residual errors remaining in the system that must be removed as they are discovered. The Maintenance of the software is given to the user by using the maintainability.

The maintainability is ease with which a program can be corrected, if an error is encountered. The maintenance depends on the user's requirement because there are many kinds of maintenance. Thus, the user requires maintenance because, maintenance involves understanding the software (code and related modules), understanding the effects of change, making new change. Because often during development some needs are not kept in mind. Thus,

by considering all the above points we can say that our system adapts the degree of maintainability.

3.2. Performance Requirement

1. Portability

The system portability should be taken care of without any interventions. Portability means the capability of the software to be transferred from one environment to another.

2. Security

The system should be secured and free from the unpredictable short circuits.

3. Efficiency

The system should be capable of providing the required performance related to the amount of resources of the organization.

4. Reliability

Our system sis capable enough to maintain the level of performance.

4. Development Model

Model used for Smart Water Controller System

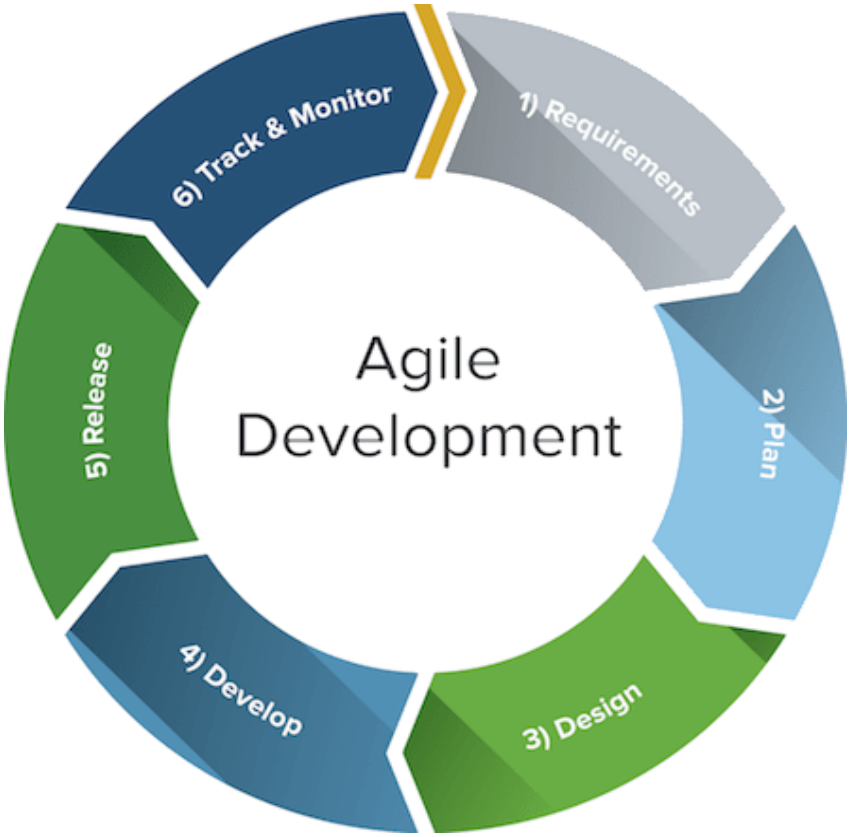

Fig No 4.1 Agile Development Model

The Agile model was primarily designed to help a project to adapt to change requests quickly. So, the main aim of the Agile model is to facilitate quick project completion. To accomplish this task agility is required. Agility is achieved by fitting the process to the project, removing activities that may not be essential for a specific project. Also, anything that is wastage of time and effort is avoided.

Actually Agile model refers to a group of development processes. These processes share some basic characteristics but do have certain subtle differences among themselves.

In the Agile model, the requirements are decomposed into many small parts that can be incrementally developed. The Agile model adopts Iterative development. Each incremental part is developed over an iteration. Each iteration is intended to be small and easily manageable and that can be completed within a couple of weeks only. At a time one iteration is planned, developed and deployed to the customers. Long-term plans are not made.

Agile model is the combination of iterative and incremental process models. Steps involve in agile SDLC models are:

- Requirement gathering
- Requirement Analysis
- Design
- Coding
- Unit testing
- Acceptance testing

Principles of Agile model:

- To establish close contact with the customer during development and to gain a clear understanding of various requirements, each Agile project usually includes a customer representative on the team. At the end of each iteration stakeholders and the customer representative review, the progress made and re-evaluate the requirements.
- Agile model relies on working software deployment rather than comprehensive documentation.
- Frequent delivery of incremental versions of the software to the customer representative in intervals of few weeks.
- Requirement change requests from the customer are encouraged and efficiently incorporated.
- It emphasizes on having efficient team members and enhancing communications among them is given more importance. It is realized that enhanced communication among the development team members can be achieved through face-to-face communication rather than through the exchange of formal documents.
- It is recommended that the development team size should be kept small (5 to 9 peoples) to help the team members meaningfully engage in face-to-face communication and have collaborative work environment.

5. Project Design

Feasibility Study

A **feasibility study** is an evaluation of a proposal designed to determine the difficulty in carrying out a designated task. Generally, a feasibility study precedes technical development and project implementation.

1. Technology and System Feasibility

The assessment is based on an outline design of system requirements in terms of Input, Processes, Output, Fields, Programs, and Procedures. This can be quantified in terms of volumes of data, trends, frequency of updating, etc. in order to estimate whether the new system will perform adequately or not. Technological feasibility is carried out basically to determine whether the company has the capability in terms of software, hardware, personnel and expertise to handle the completion of the project. HCL fulfilled all the above requirements for the efficient working of web application.

2. Economic Feasibility

Economic analysis is the most frequently used method for evaluating the effectiveness of a new system. More commonly known as cost/benefit analysis, the procedure is to determine the benefits and savings that are expected from a candidate system and compare them with costs. If benefits outweigh costs, then the decision is made to design and implement the system. An entrepreneur must accurately weigh the cost versus benefits before taking an action.

3. Cost Based Study

It is important to identify cost and benefit factors. Cost and benefits can be categorized into the following categories. Basically it is an analysis of the costs to be incurred in the system and benefits derivable out of the system. In a broad sense the costs can be divided into two types 1. Development costs 2. Operating costs.

4. Time Based Study

Contrast to the traditional system management it can generate any information of data just by single click and it saves user time .No extra time is being provided to deliver application.

5. Operational Feasibility

It is a measure of how well a proposed system solves the problems, and takes advantages of the opportunities identified during scope definition and how it satisfies the requirements identified in the requirements analysis phase of system development. This project provide interactive interface to generate report as per the requirements and also user can update the information efficiently. Most of the staff in NIC is computer literate hence the user would be

able to use the system. Further NIC also have trained manpower who can keep the system operational and upgrade it if needs arises.

5.1 Use case Diagram

"Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases".

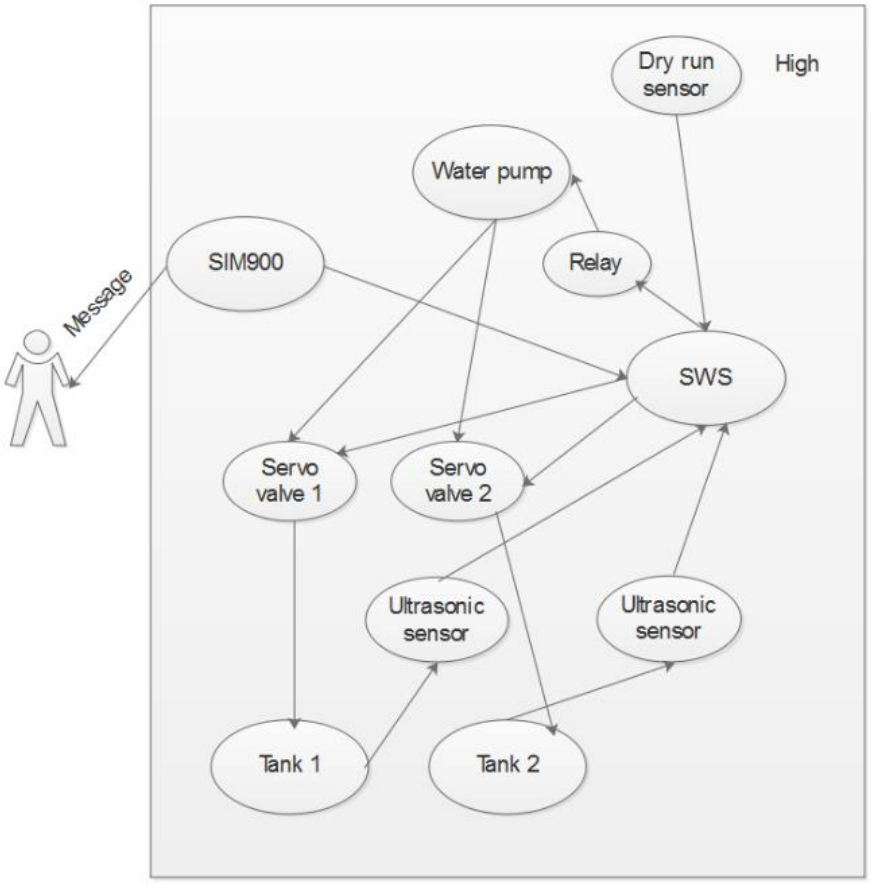

Fig No 5.1.1 Use Case for SWS

5.2 Data Flow Diagram

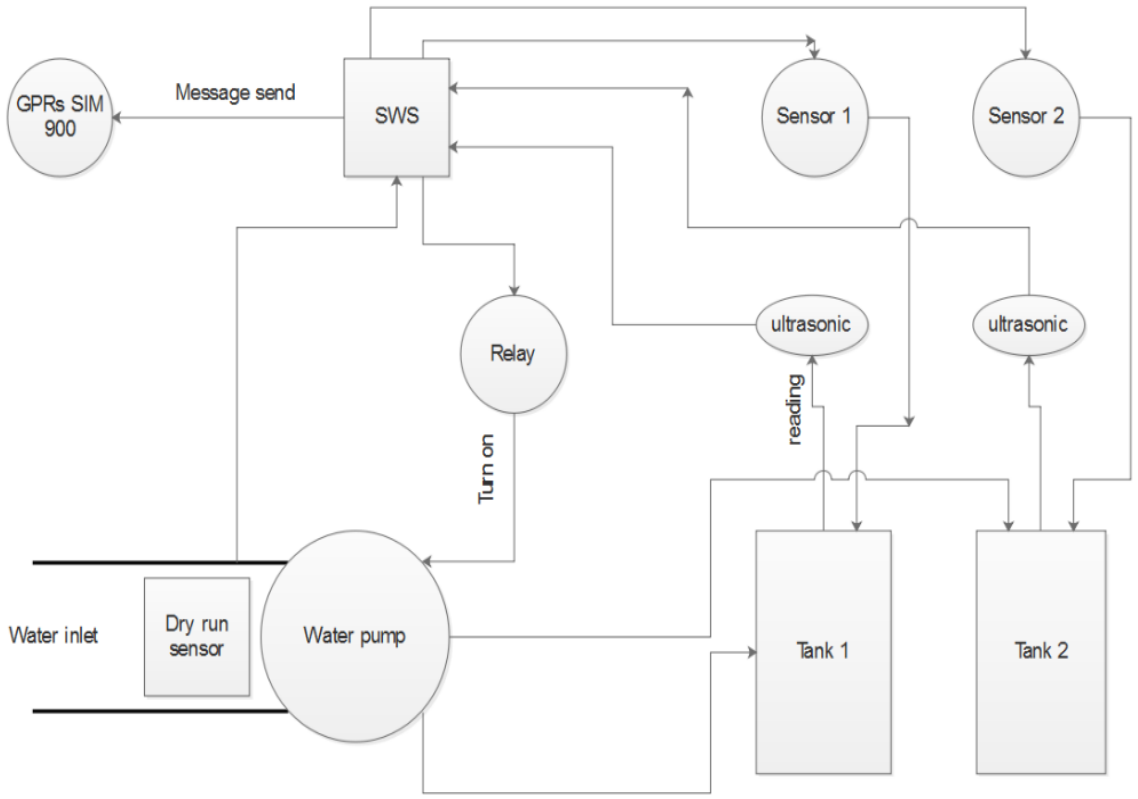

Fig No 5.2.1 DFD for SWS

- A data-flow diagram (DFD) is a way of representing a flow of a data of a process or a system (usually an information system).
- The DFD also provides information about the outputs and inputs of each entity and the process itself.
- A data-flow diagram has no control flow, there are no decision rules and no loops.

5.3 State Machine Diagram

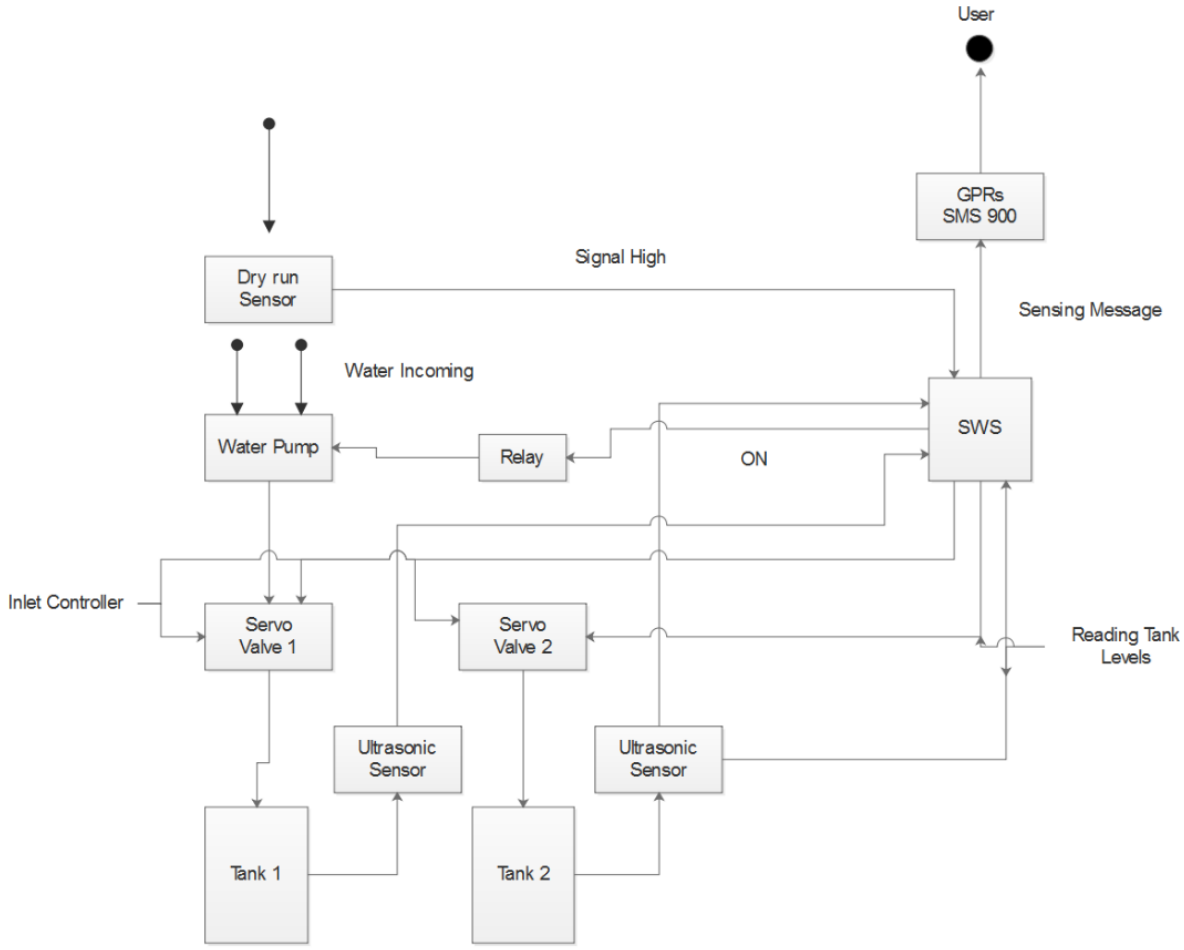

Fig No 5.3.1 State Machine Diagram for SWS

- State machine diagram typically are used to describe state-dependent behaviour for an object.
- An object responds differently to the same event depending on what state it is in.
- State machine diagrams are usually applied to objects but can be applied to any element that has behaviour to other entities.

5.4 E R Diagram

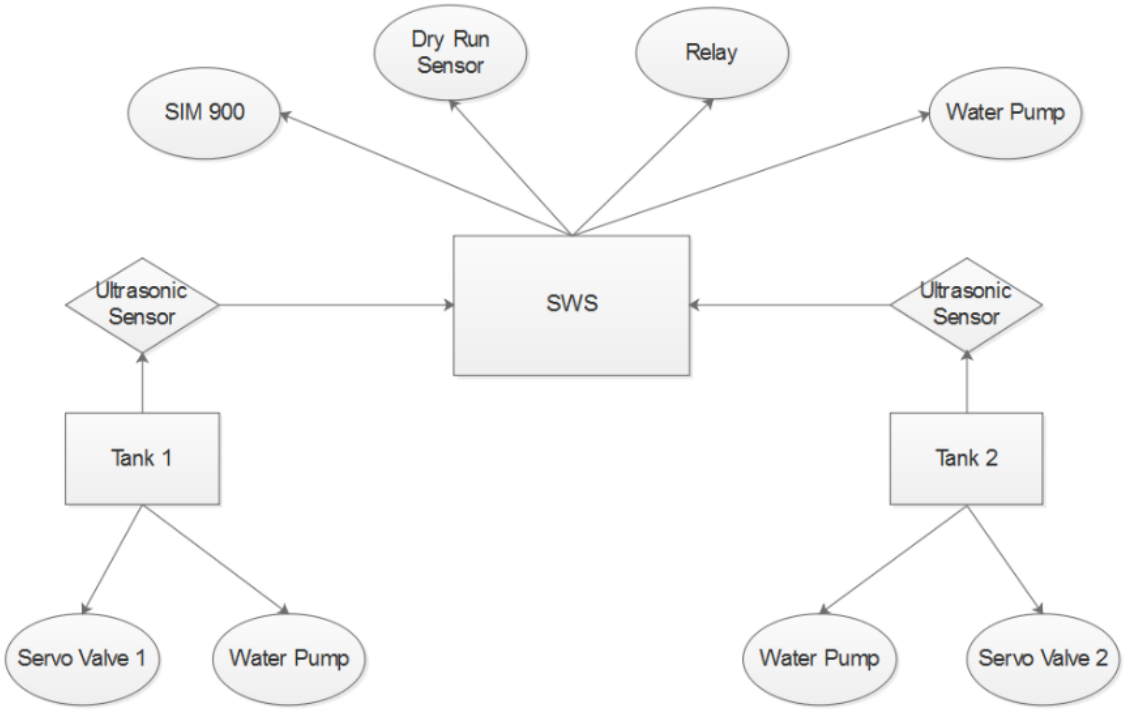

Fig No 5.4.1 ER Diagram for SWS

- An entity relationship diagram (ERD) shows the relationships of entity sets stored in a database.
- An entity in this context is an object, a component of data.
- An entity set is a collection of similar entities. These entities can have attributes that define its properties.

6. System Testing

6.1 LEVELS OF TESTING

1. Unit Testing

Unit testing is a procedure used to verify that a particular segment of source code is working properly. The idea about unit tests is to write test cases for all functions or methods. Ideally, each test case is separate from the others. Unit testing focuses verification efforts on the smallest unit of software design, the software component or module. Using the component level design description as a guide, important control paths are tested to uncover errors within the boundary of the module. The relative complexity of test and uncovered errors is limited by the constraints scope established for unit testing. The unit test is white box oriented, and the step can be conducted in parallel for multiple components. In this project many aspects are covered under unit testing, because if any of the function does not work properly then system may be fail.

2. Integrated Testing

Integrated testing is a systematic technique for construction of the whole program structure whole at the same time conduction tests to uncover errors associated with interfacing. The objective is to take unit tested components and build a program structure that has been dictated by design. Integrated testing follows unit testing and precedes system testing. Integration testing takes as its input, modules that have been checked out by unit testing, groups them in larger aggregates, applies tests defined in an integration test plan to those aggregates, and delivers as its output, the integrated system ready for system testing. The purpose of Integration testing is to verify functional performance and reliability requirements placed on major design items.

3 .System Testing

System testing is executing a program to check logic changes made in it and with the intention of finding errors-making the program fail. Effective testing does not guarantee reliability. Reliability is a design consideration.

4 . Acceptance Testing

Acceptance testing is conducted by a customer to verify that the system meets the acceptance criteria of the requested application. It generally involves running a suite of tests on the completed system. Each individual test, known as a case, exercises a particular operating condition of the user's environment or feature of the system, and will result in a pass or fail boolean outcome. There is generally no degree of success or failure.

Alpha Testing

Alpha testing is an actual operational testing done by potential users/customers or an independent test team at the developers' site, but outside the development organization. In other words, alpha testing is a type of acceptance testing carried out at developer’s site by users (internal staff). In this type of testing, the user goes on testing the system and the outcome is noted and observed by the developer simultaneously.

Beta Testing

Beta testing comes after alpha testing. Beta testing is considered the second phase of software testing. Beta tests are typically external tests to identify any performances issues or bugs prior to an official release. Beta tests can be open or closed. A closed beta test is used to control the number of users participating. An open test is open to anyone who has an interest in beta testing.

Beta testers are important because it is almost impossible for developers to test their software in all of the various conditions that might occur. Software should never be released without thorough beta testing. It is impossible to predict or test software on all kinds of hardware with other applications. Some developers segment the closed beta into different release stages so they can maximize feedback. Historically the majority of feedback is received from beta testers within the first week of the beta release.

6.2 Testing Methodology

1. Black Box Testing

Black-box test design treats the system as a "black-box", so it doesn't explicitly use knowledge of the internal structure. Black-box test design is usually described as focusing on testing functional requirements. Majority of the application are tested by black box testing method. We need to cover majority of test cases so that most of the bugs will get discovered by black box testing. Test cases can be designed as soon as the functional specifications are complete.

2. White Box Testing

White box testing strategy deals with the internal logic and structure of the code. White box testing is also called as glass, structural, open box or clear box testing. The tests written based on the white box testing strategy incorporate coverage of the code written, branches, paths, statements and internal logic of the code etc. In order to implement white box testing, the tester has to deal with the code and hence is needed to possess knowledge of coding and logic i.e. internal working of the code.

White box test also needs the tester to look into the code and find out which unit/statement/chunk of the code is malfunctioning.

Basic tests done in white box testing are

- Defining the data and control flow in the program
- Uniform representation of the program, language independent
- Simple basic elements: assignment and condition
- Statement: each statement executed at least once
- Branch: each branch traversed (and every entry point taken) at least once Branch Coverage requires that each branch will have been traversed, and that every program entry point will have been taken, at least once.
- Condition: each condition True at least once and False at least once

- Branch/Condition: both Branch and Condition coverage achieved
- Compound Condition: all combinations of condition values at every branch statement covered (and every entry point taken). It also known as Multiple Condition Coverage.
- Path: all program paths traversed at least once
- Every program entry point will have been taken, at least once.
- Loop Coverage requires that the body of loops be executed 0, 1, 2, t, max, and max+1 times, where possible.

7. Conclusion

The proposed mechanism of water control reduces the water wastage, ensures efficient use of available water resources and generates more precise and accurate results. There is no requirement of human laborer for monitoring the level, just one operator is sufficient for opening and closing the gate according to sensor output. Due to the number of sensors being more we can open or close the gate whenever necessary knowing the accurate level of water. Also, operation execution time is less.

Automatic water pump control system employs the use of different technologies in its design, development, and implementation. The system used microcontroller to automate the process of water pumping in an over-head tank storage system and has the ability to detect the level of water in a tank, switch on/off the pump accordingly and display the status on an LCD screen. This research has successfully provided an improvement on existing water level controllers by its use of calibrated circuit to indicate the water level and use of DC instead of AC power thereby eliminating risk of electrocution.

8. Future Scope

As the world's water resources become increasingly stressed, effective systems for management become more important. Several water monitor systems are available but most of them are either expensive or requires manpower. Since wired technology is used in our proposed system there is scope to further modify it by using wireless RF technology. Thus, the communication between the controller and the driving element can be established wirelessly.

Improvements can be made with minor changes in this model by eliminating the operator and providing the complete control to microcontroller (automatic level control). It can be used for level monitoring and control in industries. The system can also be extended to efficient functioning of dams. Therefore, a major future work can be possible in which a centralized control of all the dams in a state using GPRS or other wireless technology under central government can be beneficial to the whole country.

On a local level, the control of all the water storage tanks in a society using wireless technology under a trusted authority can be beneficial as well.

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