Automatic water distribution with control system

Sanjay Nandaniya

Custom Software Development Sr Analyst, Greater Than Symbol - Accenture

Email - nandaniyasanjay123@gmail.com

Abstract: *The final year project work as a source of practical knowledge that one gets to learn through research of previous made inventions, studying their problems and deficiencies. Keeping them in mind a solution for those problems is found and resolved, resulting in a better project design which is more efficient and problem free than its predecessors. Applying the same research and problem solving skills, we, the final year students of Bachelor of technology (Instrumentation and control), have taken the project of 'Automatic water distribution with control system' as our final year project. Today's modern day society takes the automation system. Thus a Automatic Water Distribution System that is affordable and efficient at its work is a necessity in every area, city, farms, society, irrigation purpose . We have made Automatic Water Distribution   System that uses much lesser resources, is easier to install, and provides the same amount of water flow.*

Keywords: *Automated, Water Level, water distribution system.*

1. INTRODUCTION :

Today, the problem of water in the urban area is increasing very much. And it is very difficult to deliver the exact amount of water to the particular area. So, with the help of this project automatic water distribution system, we prevent the loss of water and saving the water, this project being created by that purpose.

The issue of human control over valve on/off will also be resolved with the usage of this project: automatic valve on/off. Using an AC pump, an operator uses primary water resources to automatically fill the tank. The level of the water that is poured into the main tank is detected by a level sensor. When the main tank's water level reaches FULL, or full, the AC pump will automatically turn off. The AC pump will activate on its own when the main tank's water level is EMPTY. Then we send the command to gsm through Arduino (ATMEGA 328) and arduino solenoid valve can be on/off by using particular command of gsm . this is a basic goal of our project. This system provide automatic control and distribution of water in a particular area and society. This framework give programmed control and circulation of water in a specific region and society. it is extremely helpful into a smart city, industrial water supply by specific range, exotica and so on. This framework gives totally programmed circulation of water into a particular region.

1.1   Purpose of water distribution system

The dispersion framework's goal is to deliver water to clients in the right quantity, quality, stream, and weight. The entire water supply system, from the source to the point of use, is depicted using a conveyance framework. The quality of the water shouldn't deteriorate in the circulation funnels. We have try to provide automatic water distribution in a different area, farms, gardens, irrigation purpose, smart city, society etc. this system provide exact amount of water flow in a particular areas . we have also try to provide security system against water theft (direct connect motor with main line) . These days, a water supply framework consists of a foundation that collects, cleans, stores, and distributes water between consumers and water sources. The world's rapidly growing population and limited availability of fresh, regular water sources have made innovative approaches to managing the water supply system necessary.

1.2   Problems with conventional automatic water distribution system

There are four types of problems currently available in the automatic water distribution system available in the market, which are:

- Not exact amount of flow of water provide in all locations(houses, areas)

- Leakage and wastage of water (water pollution)
- Inadequate pressures at tail ends of the system
- Water theft (Direct pump connect with main lines)

Today available system into a market is

- PLC based water distribution
- RFID based water distribution
- Manual valve ON/OFF types water distribution
- Arduino based water distribution

All of these systems have their own benefits and faults, some of which are: high cost, intrusive, some of them take more time to respond to the sensor triggering, where as some systems require way too much space that installing them in a regular housing facility is impossible. Another problem with conventional systems is that it requires maintenance on a regular basis, like changing the batteries of the wireless modules. Our automatic water distribution system does not require any such maintenance . our system work on the based on the command of GSM module.

2. LITERATURE REVIEW :

For figuring out the flaws of the already existing water distribution systems we went through some of the papers that got us to know about the current water distribution systems and its working. Some of the automatic water distribution system using arduino given brief. We studied an invention with the same name "AUTOMATIC WATER DISTRIBUTION" which specializes technique for we used for our application and recognition through a controller. This invention is used water distribution system in different area, society.

To expanded detecting capacity. Of sensor contrast the sensor and minimal effort or high cost of sensor to expanded the adaptability of controller give effortlessly programming dialect. It built up a control framework for get ideal information of water appropriation it builds up the programming dialect or control capacity for performing errand. The datasheets for the controller and the communication module were taken from the following sites, which provided us with the specification of the controller input and output ports and operating range of the modules.

3. Materials/Tools required:

Arduino Controller (ARDUINO ATMEGA 328P):

In our project ardiuno atmega 328p is the major component that is we used to controlling or programming purpose of our project. Arduino are open source microcontrollers that are financially accessible requiring little to no effort. Arduino microcontrollers have an extensive variety of information sources and yields that likewise ADC ports for AC direct controls and additionally simple data sources. The best advantage of utilizing an Arduino controller is its amazing simplicity of programming that can be effectively done utilizing a standard PC with its own particular open source programming. There are numerous variations of the Arduino controller accessible in the market, one can pick any of them as indicated by their requirements and applications.
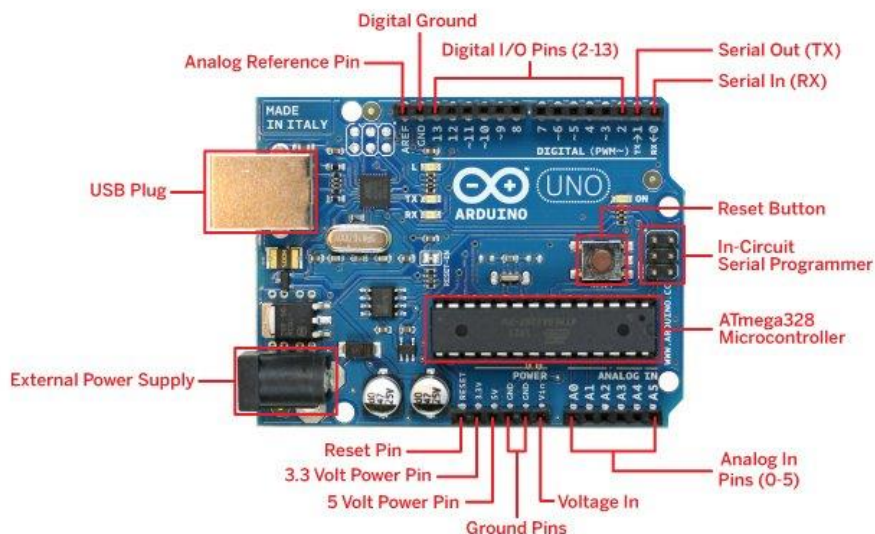

FIG.1 Arduino hardware structure

FIG.2 Arduino hardware penal structure

SPECIFICATIONS
Internal and external interrupts - 8-bit AVRRISC-based microcontroller - 32KBytes ISP flash memory with read and write capabilities - 1KBytes EEPROM - 2KBytes SRAM - 23 general purpose I/O lines - 32 general purpose working registers - 3 flexible timers/counters with compare modes - A byte-oriented - Serial programmable USART - 2-wire serial interface.

GSM MODULE:

In our project we used GSM module for sms or notification purpose GSM module collect data from controller and provide notification sms to specific device .in GSM module used simcard and connect with pc or mobile phone. GSM is basically use for our system valve on/off Through Only message application so we use GSM SIM300.

FIG.3 Layout of GSM Module

SPECIFICATIONS
Features include dual-band GSM/GPRS (900/ 1800 MHz) and an RS232 port for direct contact with computers or MCU kits. Configurable baud rate. The power is regulated by a 29302WU integrated circuit.
ESD compliant. Includes MIC and speaker socket.
Features include a slid-in SIM card slot, stub antenna, stackable UNO headers, optional microcontroller power, and external serial connections.

LEVEL SENSOR:

The instrument used to measure the liquid level in a tank is called a float switch. The switch can be used as an indication, an alert or a control for a pump, or to operate other equipment. A mercury float switch housed inside a hinged. A float that elevates a rod to activate a microswitch. We use This type of Two sensor one is lower level sensing and another one is upper level sensing . This type of sensor working on 5v . when Both Float is down the Switch ON and current path is complete and sensor sence as a "LOWER LEVEL". when Both Float is UP the Switch OFF and current path is Incomplete and sensor sence as a "HIGHER LEVEL"

FIG.4 FLOAT TYPE LEVEL SENSOR

SPECIFICATIONS
The features of this product include: • Normally Open Type (Yellow Wire) and Normally Close Type (Blue Wire) • Corrosion Free Material • Advanced Magnetic Technology • Both side sensing • Cable Length: 2 meter

SOLNOID VALVE:

A solenoid valve operates using electromechanical means. If a two-port valve should occur, the stream is turned on or off. The valve is controlled by an electric current passing through a solenoid. In fluidics, solenoid valves are the most often used control elements. Their tasks include measuring, dispersing, stopping, and blending liquids. Solenoid offers low control power, extended service life, excellent dependability, quick and safe switching, and a small, lightweight design.

24V dc

FIG.5 Solenoid valve

Control valve is used to control liquid by shifting the extent of the stream entry as straightforwardly by motion from a controller. In a programmed control phrasing - control valve is named a "Final control component".

TIP122 (Darlington Pair Transistor) :

We use here TIP122 Darlingston pair TRANSISTOR as a switching application . We can give command signal from arduino is given in TIP'S base pin . And solenoid valve connect between TIP'S collector and emitter . And 24 v given TIP'S emitter pin. And also include TIP for Relay operation.

An NPN transistor with a Darlington pair is the TIP122. With a Darlington pair inside, it performs similarly to a typical NPN transistor but has an excellent collector current rating of around 5A and a gain of roughly 1000. It is also capable of withstanding around 100V across its collector-emitter, making it suitable for driving large loads.

SPECIFICATIONS
- Complementry Power Darlington Transistors
- 100 V/5A
- NPN/PNP pair in To-220 casing
- Drive motors, relays, toys, solenoids, actuators, speakers
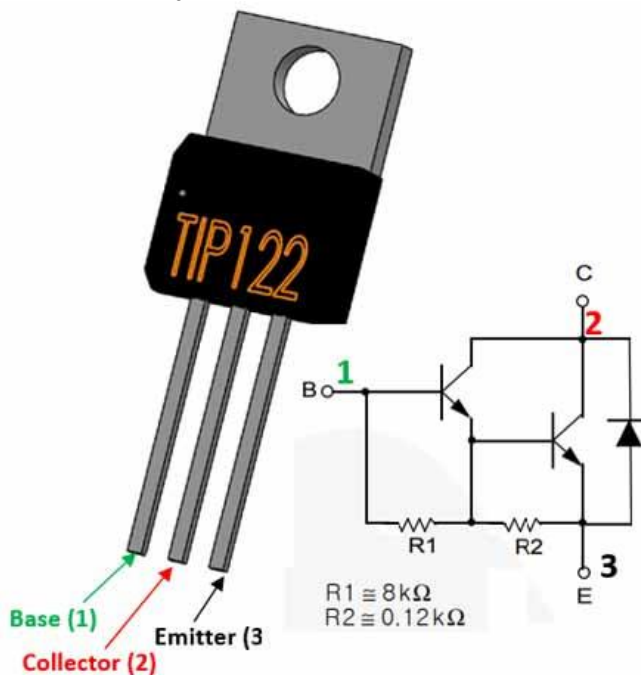- Useful in DIY Audios. Robots, Projects,solar, servos

Fig.6 TIP pin layout

PUMP MOTOR

We use as per our project application small AC pump (use in cooler and RO system) or BLDC (brushless dc pump) . We use as per our project application small AC pump (use in cooler and RO system) .Ac pump base on operate through relay and TIP operation

Fig.7 AC PUMP

Brushless garden fountain pump, 12 volt, small DC. This little pump can be submerged; simply submerge it in water to start pumping. appropriate for a tank, little pond, garden accent, oxygen-producing water circulation system, etc. The greatest water submersible pump (18 w) for coolers, fountains, and aquariums is the original globes (master) brand.

SPECIFICATIONS

- Voltage: 150-220 v / 50 hz
- Power: 19W
- Weight : .385kg
- Size : 3.5x3x3 inch

RELAY :
Relay is which is used to isolate two circuits electrically as an electromagnetic device and connect them magnetically. Relay is a basically ON/OFF device. relay basically used for a switching purpose.
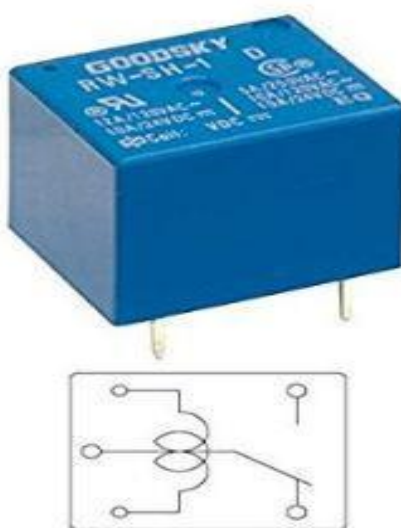

Fig.8 Relay layout

TERMINAL WIRE :
The terminal wire we used for connecting the ardiuno board with relay card and another devices.

Fig.9 Terminal wire

SUPPLY - Power:
    Power supply circuit, the name itself indicates that this circuit is used to supply the power to other electrical and electronics circuits or device.
    There are different types of power supply circuits based on the power supply they are used to provide for devices.
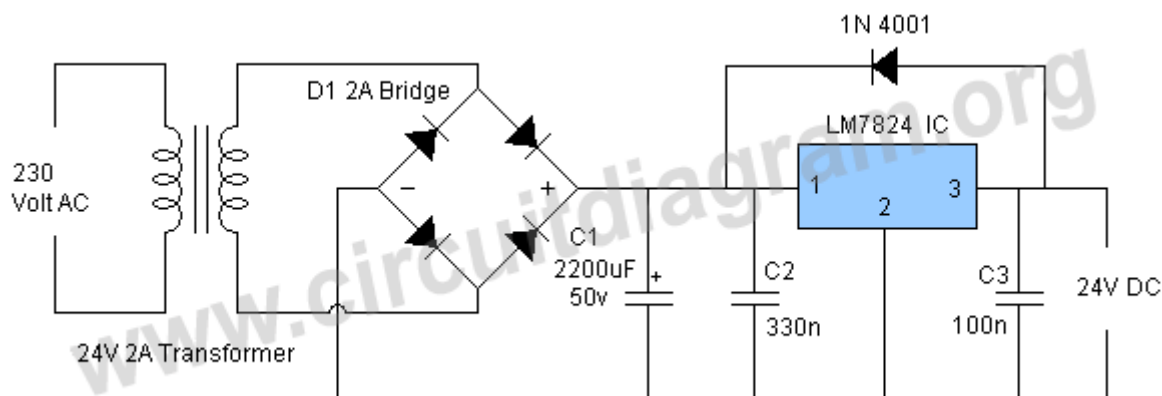
Fig.10 24 Volt power supply

4. Design: Design Methodology and Implementation

4.1 AEIOU SUMMARY CANVAS :
In AEIOU summary canvas we mention details relate to environment, activities, interaction, objects, and users related to our project.
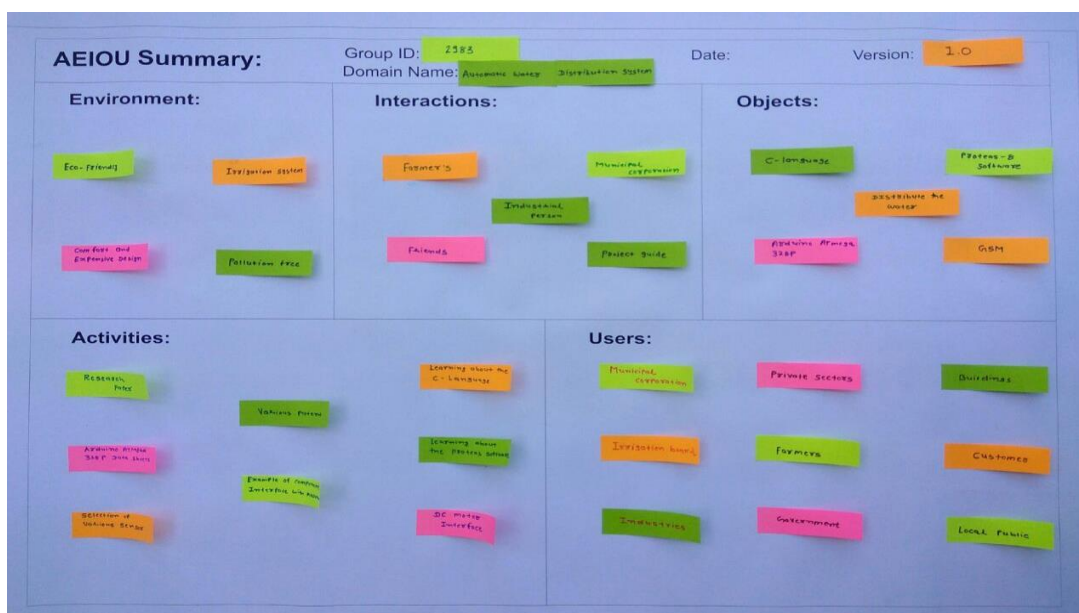

Fig.11 AEIOU Summary Canvas

Environment:
- Eco- Friendly
- Comfort and Expensive Design
- Pollution free
- Irrigation System

Activities:
- Research Paper
- Selection of various Sensor
- Various patent
- Arduino ATmega 328p

- AC motor Interface
- Learning about Proteas software

Interaction:
- Municipal Corporation
- Farmers
- Industrial person
- Project Guide
- Friends

Objects:
- C- Language
- Proteas-8 software
- Distribute the water
- Arduino ATmega 328p
- GSM

Users:
- Municipal Corporation
- Private Sector
- Industries
- Farmers
- Local public
- Irrigation board

4.2 EMPATHY MAPPING CANVAS :

In empathy mapping canvas we define our stock holders which is present at we find out our problem also we define a user, we mention an activity which we done at that time, we observe some situation happy or sad.
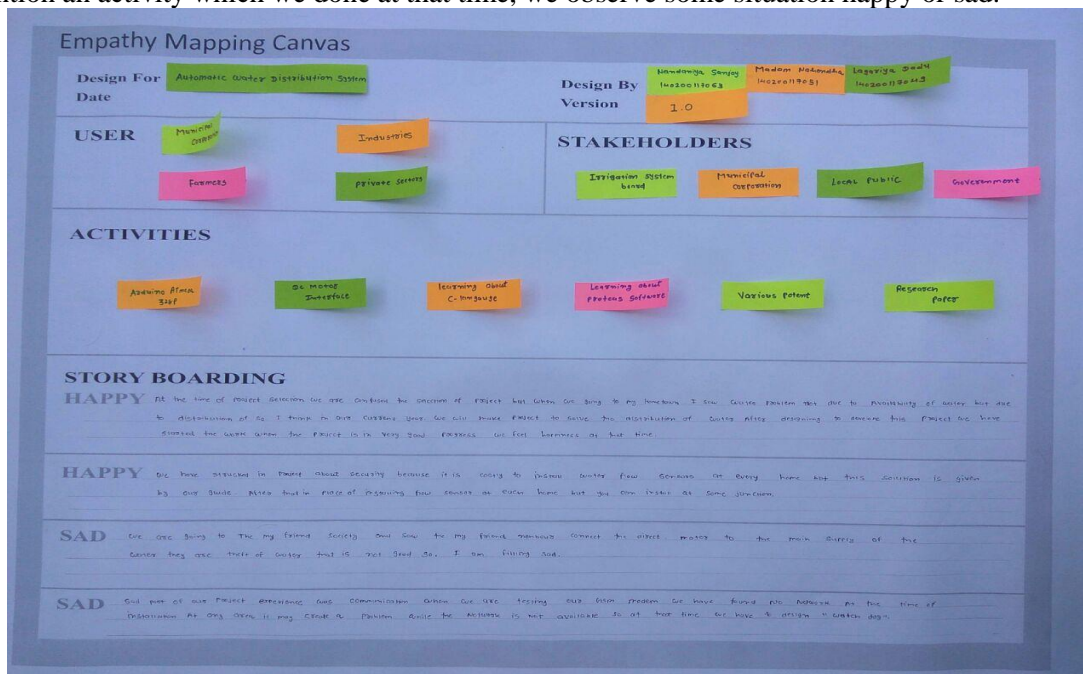

Fig.12 Empathy Mapping Canvas

Users:
- Municipal corporation
- Industries
- Farmers
- Private sector

Stack holder:
- Irrigation system board
- Municipal corporation
- Local public
- Government

Activities:
- Research Paper
- Selection of various Sensor
- Various patent
- Arduino ATmega 328p
- AC motor Interface
- Learning about Proteas software

4.3 IDEATION CANVAS :

- In this canvas we mention about our project people, activities, situation, and props/possible solution.
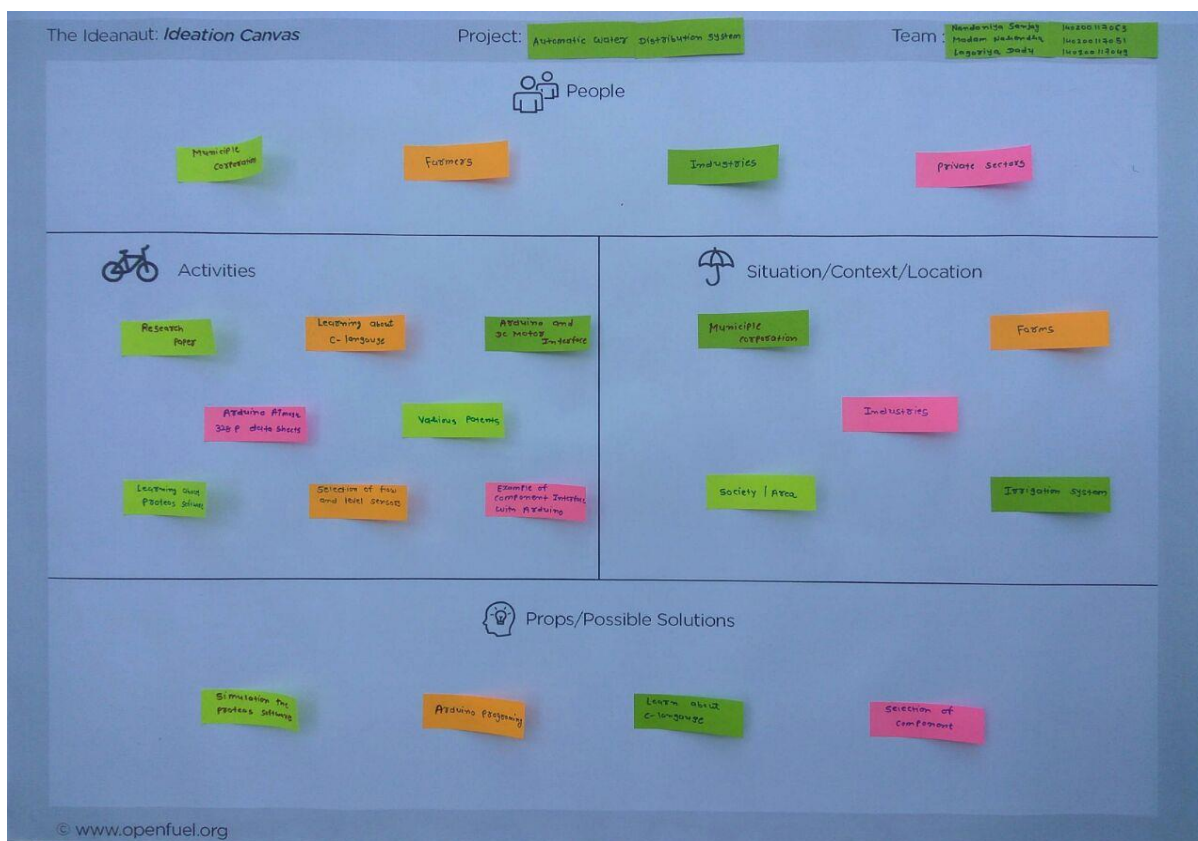

Fig.13 Ideation Canvas

People:
- Municipal Corpporation
- Farmers
- Industries
- Private Sector

Activities:
- Research paper
- Learning about C-langauge
- Learning about Proteas software
- Various patent

- Arduino and AC motor Interface
- Arduino ATmega 328p Data sheets
- Selection of flow and level sensors

Situation:
- Municipal corporation
- Farms
- Industries
- Society/ local area
- Irrigation board

Props/possible solution:
- Simulation the proteas software
- Arduino programming
- Learn about c-langauge
- Selection of component

4.4 PRODUCT DEVLOPMENT CANVAS:

In product development canvas we include the details related to our products like product experience, product functions, product features. And also we described the details about components, customer revalidation, and purpose of the project. The fig is mention below.
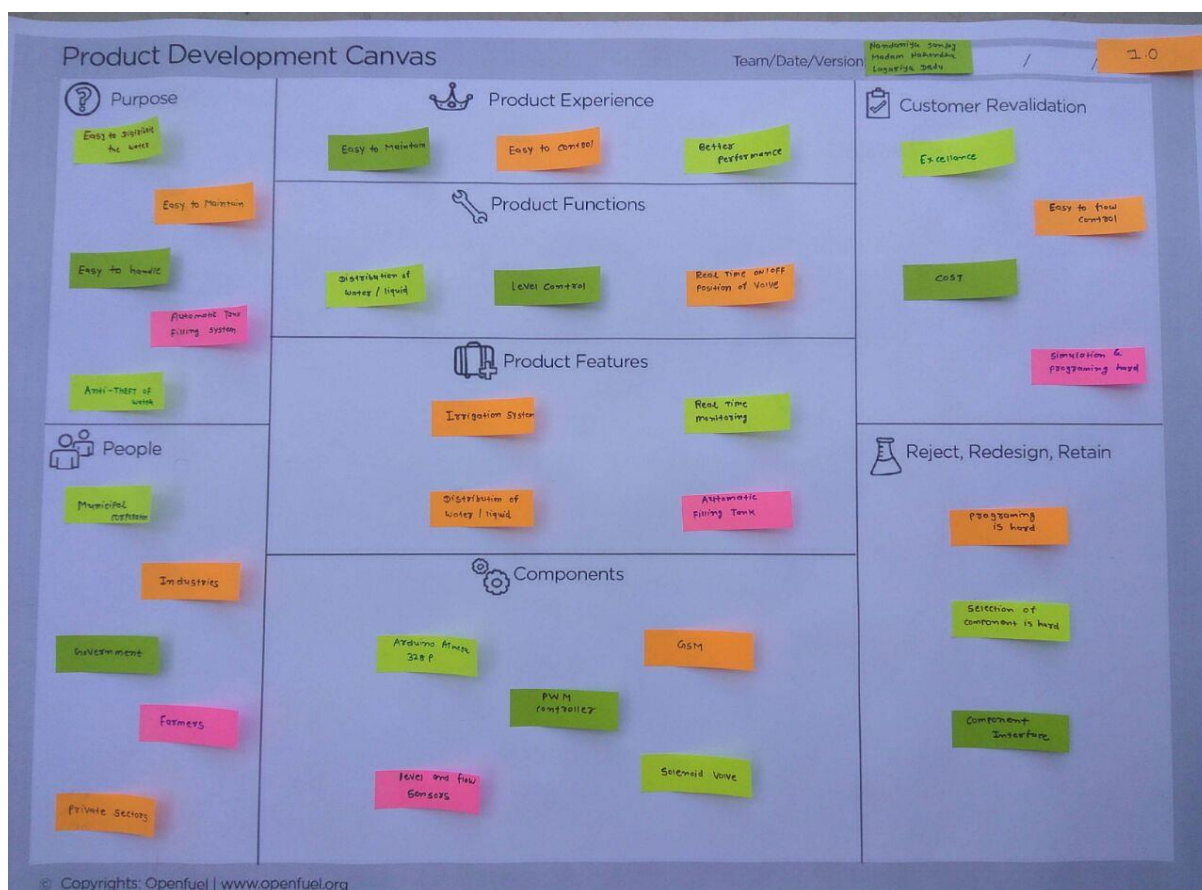

Fig.14 Production Development Canvas

Purpose:
- Easy to Distribute the water
- Easy to Maintain
- Easy to Handle
- Automatic Tank filling system

- Anti-Theft of Water

People:
- Municipal Corporation
- Industries
- Farmers
- Government
- Private sector
- Local public

Product experience:
- Easy to maintain
- Easy to Handle
- Better Performance
- Easy to control

Product function:
- Distribute the water/liquid
- Level control
- automation
- Real time ON/OFF position of Valve

Product features:
- Irrigation system
- Real time monitoring
- Distribute of water /liquid
- Automatic tank filling system

Component:
- Arduino ATmega 328p
- GSM
- Controller
- Solenoid valve
- Level Sensor
- Flow sensor
- AC pump Or BLDC pump
- Power supply

Customer revalidation:
- Excellance
- Easy to flow control
- Cost
- Simulation and programming hard

Reject, redesign, Retain
- Programming is hard
- Selection of component is hard
- Comfort Interface

4.5 BUSINESS MODEL CANVAS :

In this business model canvas include the detail related to our project like Key partners , key activities , key resources, value propositions , Customer relationship , channels of project , customer segmentations , cost structures and Revenue Streams.
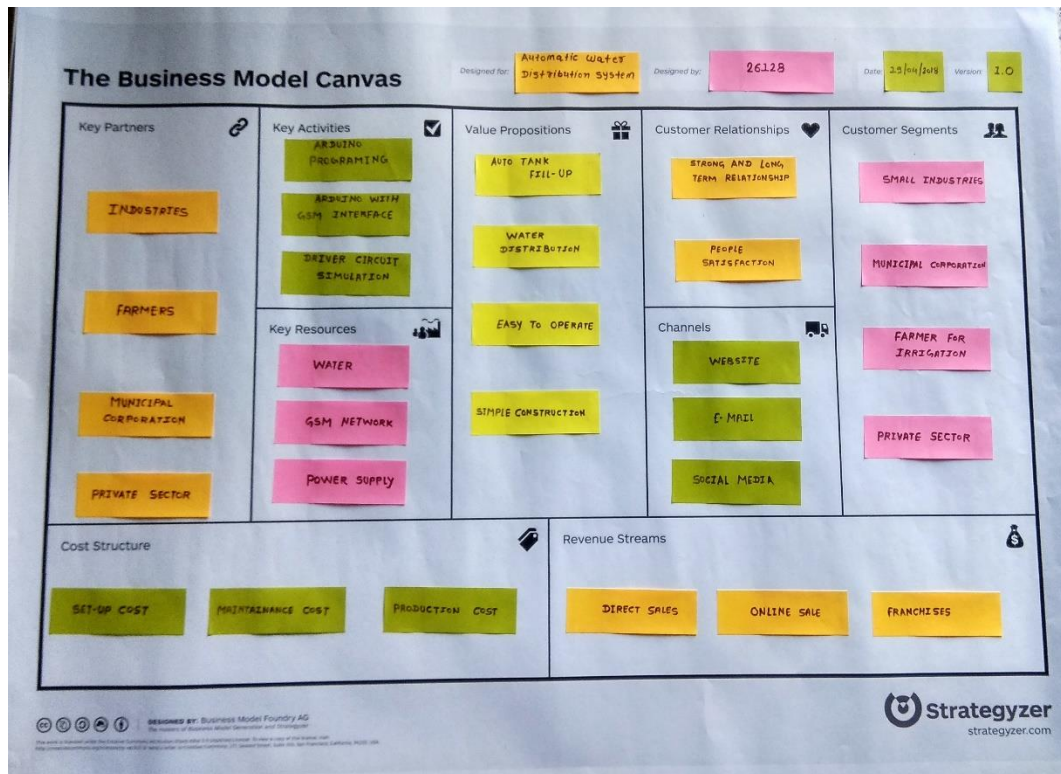

Fig.15 Business model Canvas

Key Partners
- Industries
- Farmers
- Municipal Corporation
- Private Sectors

Key Activates
- Arduino Programming
- Arduino with GSM interface
- Driver Circuit Simulation

Key Resourses
- Water
- GSM Network
- Power Supply

Value Propositions
- Auto tank Fill-UP
- Water Distribution
- Easy to Operate
- Simple Construction

Customer Relationships
- Strong and long term relationships
- People Satisfaction

Channels
- Website
- E-MAIL
- Social Media

Customer Segments
- Small Industries
- Municipal Corporation
- Farmer for Irrigation
- Private Sector

Cost Structure
- Set-up Cost
- Maintenance Cost
- Production Cost

Revenue Streams
- Direct Sale
- ONLINE Sale
- Franchises

5. Implementation and Diagram :

5.1 Water Distribution System Block Diagram

In this semester we have built up our venture programmed water distribution system framework , Block Diagram , segments choice , parts detail , Programs , Driver circuit board simulation , final project hardware simulation , and some another works . fundamentally our objective to make this undertaking is we have endeavor to disseminate water into a shrewd city, ranches , gardens , zones and so on . We have likewise endeavor to make a security frameworks against water theft (coordinate engine associate with principle line) . our more execution will be next term.
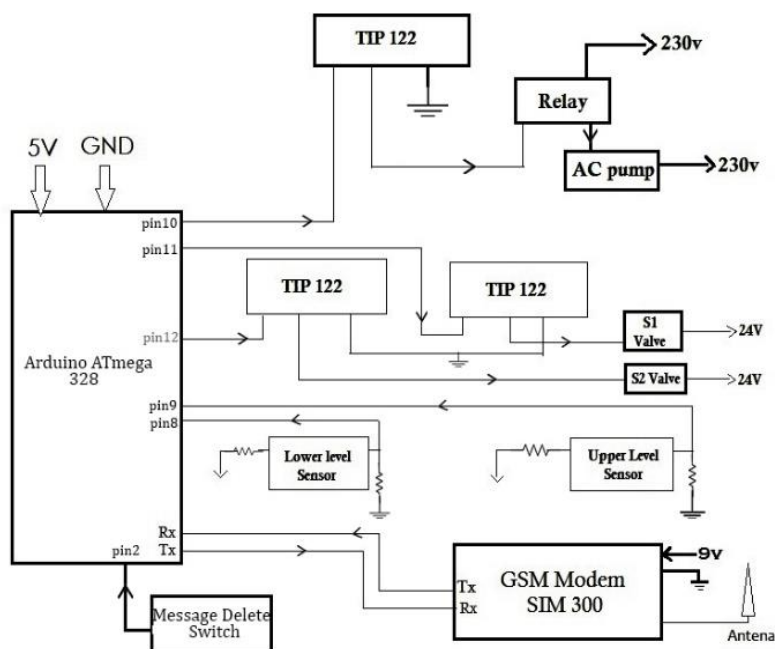

Fig.16 BLOCK DIAGRAM OF WATER DISTRIBUTION SYSTEM

We creating water dispersion framework the level sensor we utilize FLOAT TYPE MAGNETIC sensor it is sense the level of water into a tank and make a move an AC pump or BLDC . in the event that level of the tank is over 100%(FULL) at that point pump will be OFF and level of the tank is underneath 0%(EMPTY) at that point pump will be ON.

After we utilize GSM we send summon to GSM and arduino to activity against valve ON/OFF. we have attempt to give correct measure of stream in an all zones, zones, society to give security against water theft .

5.2 DRIVER CIRCUIT BOARD :

Driver Circuit is basically use for operate a solenoid valve and AC relay through AC pump. we use here TIP122 Darlingston pair TRANSISTOR as a switching application . We can give command signal from arduino is given in TIP'S base pin . And solenoid valve connect between TIP'S collector and emitter . And 24 v given TIP'S emitter pin. And also include TIP for Relay operation.
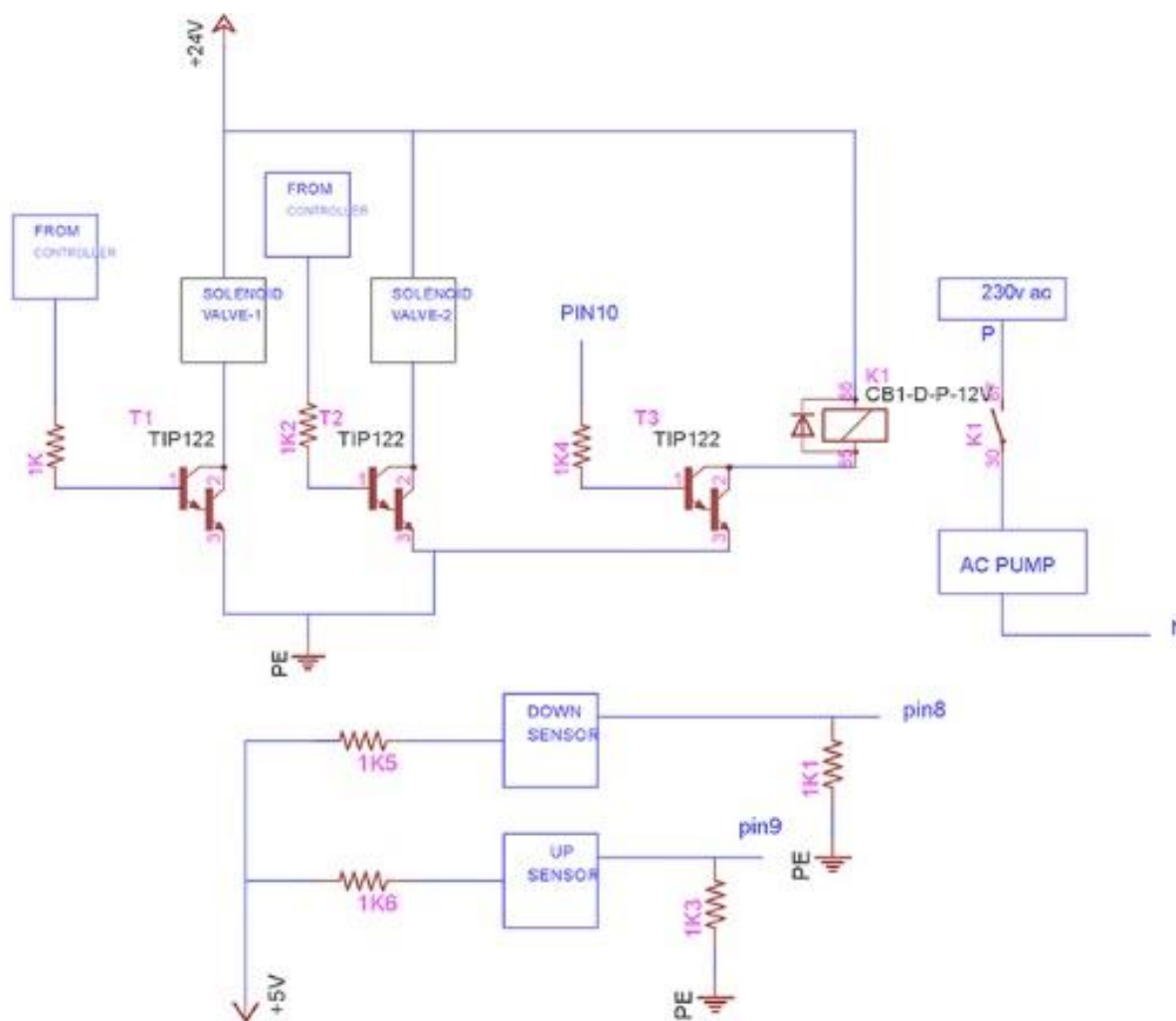
Figuer.17 Driver Circuit

5.3 SYSTEM WORKING :

- After interconnecting(network connected) the GSM(9v) Modem, Arduino and driver board power on the different supply (230v,24v,5v). Make sure that GSM Modem connected to the servicer provider network. When system is running arduino check the main tank level and also check the incoming message for valve operation.
- Both the process are parallel. If bottom and top float sensor detect low water level arduino start the AC pump by giving start pulse to the relay section. After detecting the full water level arduino stop the AC pump by giving stop pulse to the relay section. In this way main water tank is filling.
- Text message to GSM for operating the society valve on or off. Simply send the text message as below ,
  - ❏ S1 for society 1
  - ❏ S2 for society 2

❑ To ON the valve type as below and text to the specified no. "s11,s21" or "s11" or "s21" To OFF the valve type as below and text to the specified no. "s10,s20" or "s10" or "s20".

• After receiving the message GSM feedback to the specified no about the operation like "Society1 valve on and society2 valve off " this is for text message "s21,s20".

• Also send the message when main tank is filling and main tank filled.

• In this way automatic water management system work and distribute the water from the remote location.

5.4 RESULTS :

In this implication of our project above we describe about our project. And this semester our project result is the our project finally run completely to providing automatic water distribution system using ARDUINO and GSM Module.

Fig.18 Structure of Water Distribution system

In figure show this complete project according to its definition in this model only automatic water distribution system is sensed by sensor and provide to controller and controller control the flow of water. The distribution based on flow is implemented using GSM and arduino are in next term .

Finally in our system is working based on that first of all connect all hardware then provide particular power supply . after first of all both sensor sense lower level and ac pump will be "ON" , and main tank filling after that both sensor sense upper level then AC pump will be "OFF" . After that We send command to GSM our operations "s11,s21,s10,s20" both are work parallel process . for example we send "S11,S21" then both solenoid valve ON . Basically GSM send command to Arduino . Finally our project done in fully working conditions .

5.5 TESTING & VERIFICATION:

When after we developing our project we test them and testing time we can test the exact amount of flow of water in a all zones data by sensor and controller the data is not obtain perfect .then we check programming and sensor.

6. Result and Future Scope :

The automatic water distribution system using arduino we produce using arduino controller because the arduino controller is   better than other controller is provide both type of analog or digital signal.

So, after we making this this project then their testing result is excellent but testing time we can't. But now testing time we want to use GSM module and their so that result now we can't identify or mention in this report.

Future Scopes:

- This project when developed on a larger scale; it can be practically implemented in the Village, Municipal Corporation or Town/ City.
- This auto system can be implemented for smart city or automated town electricity management system.
- In Municipal corporation
- In smart city
- In farms, gardens and irrigation purpose
- In home automation
- In industries
- For some application in fluid distribution system

7. CONCLUSION:

- The structure uses GSM system for correspondence tradition, gives insignificant exertion and long division correspondence which helps in checking water supply in metropolitan city. The change of this structure can decrease the abuse of water resources essentially, and make the organization of water significantly more reasonable and supportive in the city.

- Customized WATER DISTRIBUTION SYSTEM assurances to evade wastage of water and moreover diminishes time. Due to the use of Arduino Uno it is possible to screen and control the whole structure from the central control room. The diminishment of the working cost and also decreasing in the water mishaps is refined by the execution of an astute control system.

REFERENCES:
1. Sujeet Rote, Adarsh Mourya, Prof. Abhimanyu Yadav : Automatic Water Distribution System using PLC, International Journal of Engineering Research & Technology (IJERT), Vol. 6 Issue 04, April-2017. https://www.ijert.org/research/automatic-water-distribution-system-using-plc-IJERTV6IS040435.pdf
2. Prof. S.R.Kinge, Nishant Nibhoria, Pranav Singh, Rahul Kumar; AUTOMATIC WATER DISTRIBUTION SYSTEM Journal of Emerging Technologies and Innovative Research (JETIR), Volume 4, Issue 05, May 2017. https://www.jetir.org/papers/JETIR1705008.pdf
3. Ayisha Sayed1, Shivani Vatkar, Abhishek Udmale, Prof. Vinita Bhandiwad; Smart and Automatic Water Distribution Control System , International Research Journal of Engineering and Technology (IRJET), Volume: 05, Issue: 01, Jan-2018. https://www.irjet.net/archives/V5/i1/IRJET-V5I1139.pdf
4. T. Baranidharan, A.Chinnadurai , R.M.Gowri, J. Karthikeyan.;   AUTOMATED WATER DISTRIBUTION SYSTEM USING PLC AND SCADA, International Journal of Electrical and Electronics Engineers, Volume 07, Issue 01, Jan- June 2015. http://www.arresearchpublication.com/images/shortpdf/1427210399_1080.pdf
5. E.Vinothini, N. Suganya; Automated Water Distribution and Performance Monitoring System, International Journal of Engineering and Innovative Technology, Volume 3, Issue 8, February 2014.