REAL TIME RIVER WATER QUALITY MONITORING SYSTEM-IoT

PROJECT REPORT

SUBMITTED BY

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1. INTRODUCTION

1.1 PROJECT OVERVIEW:

Real-time data access can be done by using remote monitoring and Internet of Things (IoT) technology. Data collected at the apart site can be displayed in a visual format on a server PC with the help of Spark streaming analysis through Spark ML lib, Deep learning neural network models, and Belief Rule Based (BRB) system and is also compared with standard values. Also, it assures low-cost efficient water quality monitoring and control over river water. Since its battery operated, it is much safer for the locality and people to use the river water which has a low rate of electrical shocks as the battery is completely insulated and rechargeable so that the system is continuous. By using this product people can predict, and analyze the hardness of water and also the factors like temperature and turbidity of water for having safe drinking and water with better consistency forhousehold purposes.

Since water is an essential compound on a daily basis intake of it in an a healthy manner is provided by our cost-efficient quality monitoring and controlsystem which is market-affordable and a great life-saving factor for people using river water. The environment around consists of five key elements e.g., soil, water, climate, natural vegetation, and landforms. Among these water is the utmost crucial element for human life. It is also vital for the persistence of other living habitats. Whether it is used for drinking, domestic use, food production, or recreational purposes, safe and readily available water is the need for public health.

So, it is highly imperative for us to maintain a water quality balance. Otherwise, it would severely damage the health of humans and at the same time affect the ecological balance among other species. Water pollution is a foremost global problem that needs ongoing evaluation and adaptation of water resource directorial principles at the levels of international down to individual wells.

The records show that more than 14,000 people die daily worldwide due to water pollution. In many developing countries, dirty or contaminated water is being used for drinking without any proper prior treatment. One of the reasons

for this happening is the ignorance of the public and administration and the lack of a water quality monitoring system which makes serious health issues. In this paper, we depict the design of a Wireless Sensor Network (WSN) that assists to monitor the quality of water with the support of information sensed by the sensors dipped in water. Using different sensors, this system can collect various parameters from water, such as pH, dissolved oxygen, turbidity, conductivity, temperature, and so on. The rapid development of WSN technology provides a novel approach to real-time data acquisition, transmission, and processing.

The clients can get ongoing water quality information from far away. Now a day's Internet of things (IoT) is an innovative technological phenomenon. It is shaping today's world and is used in different fields for collecting, monitoring, and analysis of data from remote locations. IoTintegrated networks if everywhere starting from smart cities, smart power grids, and smart supply chains to smart wearables. Though IoT is still under-applied in the field of environment it has huge potential. It can be applied to detect forest fires and early earthquakes, reduce air population, monitor snow levels, prevent landslides, and avalanches, etc. Moreover, it can be implemented in the field of water quality monitoring and controlling system.

Water quality monitoring has gained more interest among researchers in this twenty-first century. Numerous works are either done or ongoing on this topic focusing on various aspects of it. The key theme of all the projects was to develop an efficient, cost-effective, real-time water quality monitoring system that will integrate a wireless sensor network and the internet of things.

In this research, we monitor the physical and chemical parameters of water bodies inside Chittagong city by using an IoT-based sensor network.

1.2 PURPOSE:

Current water quality monitoring system is a manual system with a monotonous process and is very time-consuming. This paper proposes a sensor-based water quality monitoring system. The main components of Wireless Sensor Network (WSN) include a

microcontroller for processing the system, communication system for inter and intra node communication and several sensors. Real-time data access can be done by using remote monitoring and Internet of Things (IoT) technology. Data collected at the apart site can be displayed in a visual format on a server PC with the help of Spark streaming analysis through Spark MLlib, Deep learning neural network models, Belief Rule Based (BRB) system and is also compared with standard values. If the acquired value is above the threshold value automated warning SMS alert will be sent to the agent. The uniqueness of our proposed paper is to obtain the water monitoring system with high frequency, high mobility, and low powered. Therefore, our proposed system will immensely help Bangladeshi populations to become conscious against contaminated water as well as to stop polluting the water.

2.LITERATURE SURVEY

2.1 EXISTING SOLUTION

Existing system has a mechanisms which are semi-automated or manually controlled devices which are to be handled by a person responsible for monitoring the water quality. There is need to have human intervention in taking various reading of the water parameters.

The instruments or tools are used either by putting/inserting a water sensing part into water and seeing the result on small display device or by directly inserting a portable device in water and watching the output on the display. Central Water Commission (CWC) monitors water quality, by collecting samples from representative locations within the processing and distribution system.

These samples are analyzed at the well-equipped laboratories. At these laboratories, samples of raw water, filter water and treated water are taken for analysis, these analysis can be performed by human intervention which for specific

period only. The disadvantage of this system is, water is not monitoring seamlessly, and it always needs a human intervention.

2.2 REFERENCES

1. K. Khurana, R. Singh, A. Prakash, R. Chhabra, An IoT Based Water Health Monitoring System, International Journal of Computer Technology and Applications (IJCTA), 9(21), pp. 07-13, 2016.

2 Guidelines for Water Quality Monitoring Central, Central Pollution Control Board, 2007-2008

3. A.S. Rao, S. Marshall, J. Gubbi, M. Palaniswami, R. Sinnott, V. Pettigrove, Design of Low-cost Autonomous Water Quality Monitoring System, International Conference on Advances in Computing, Communications and Informatics (ICACCI), 2013.

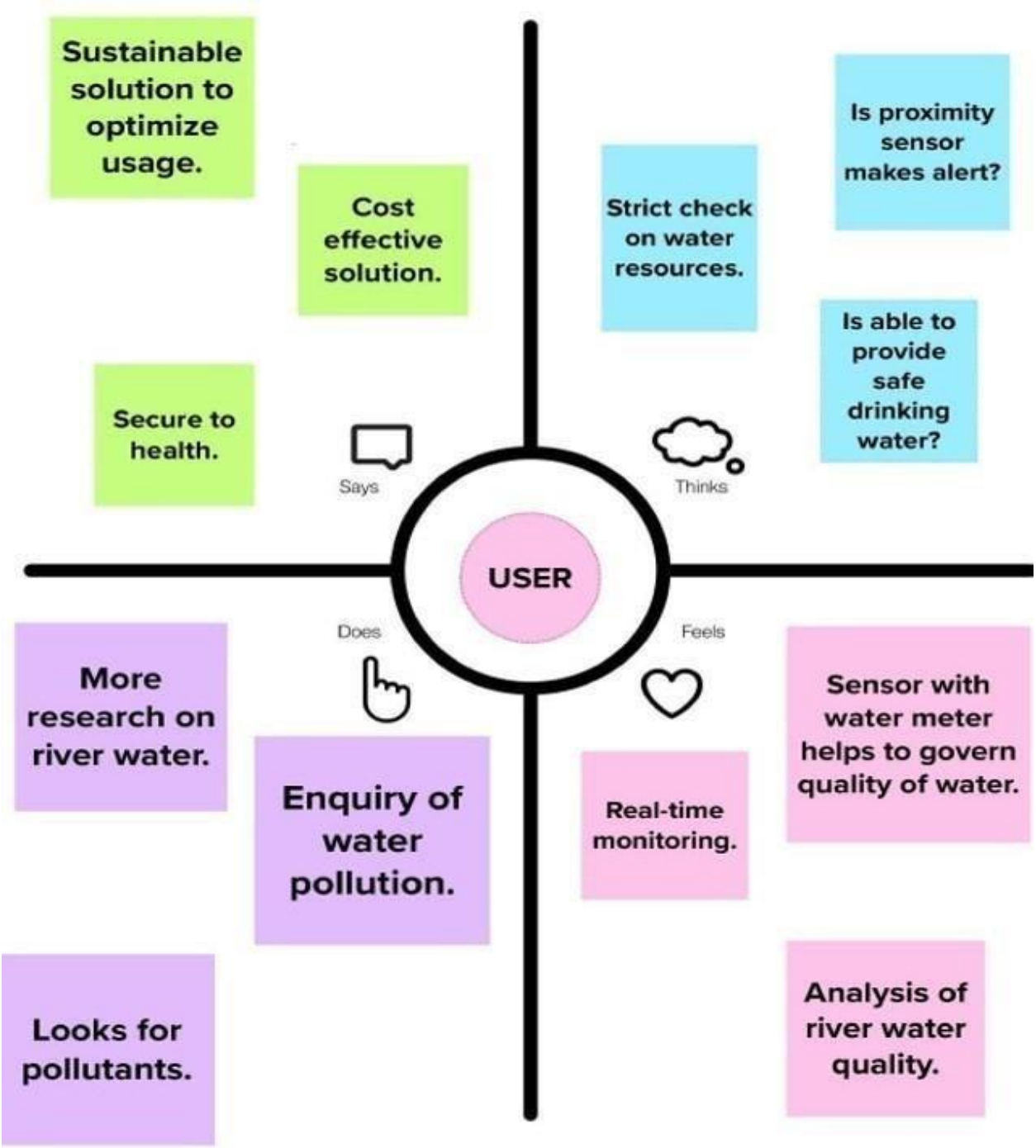
4. Australian Water Quality Guidelines for Fresh and Marine Waters, Australian and New Zealand Environment and Conservation Council, Canberra, 1992.

2.3 PROBLEM STATEMENT DEFINITION

Water is a finite resource that is necessary for agriculture, industry and the survival of all living things on the planet, including humans. Many people are unaware of the need of drinking adequate amounts of water on a daily basis. Many unregulated methods waste more water. Poor water allocation, inefficient consumption, lack of competent and integrated water management are all factorsthat contribute to this problem. Therefore, efficient use and water monitoring arepotential constraint for home or office water management system

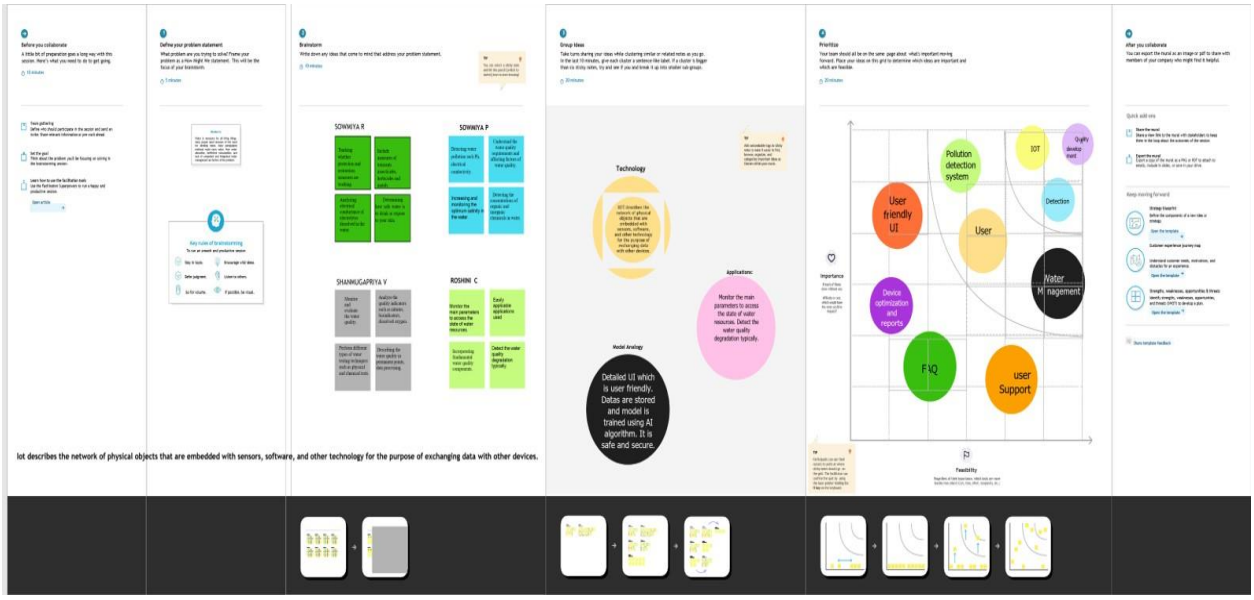
3.IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION AND BRAINSTORMING

Brainstorming



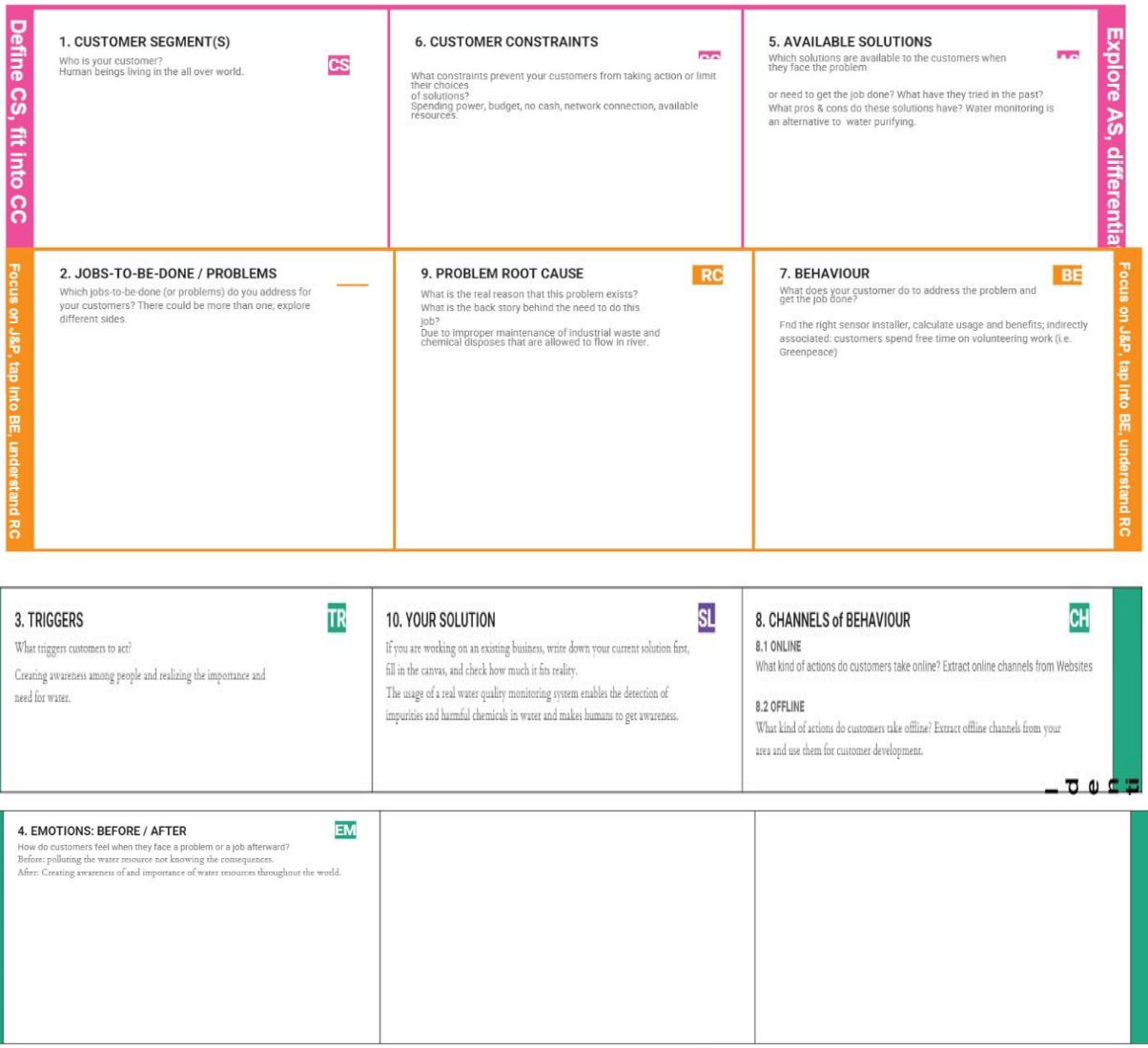
Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	I'm an	I'm trying	But i can't	Because	It makes
	villager	to take an	achive	of	me
	who	initiative of	due to that	poisonous	frustrated
	suffers	consumin	i can't find	state of	and
	from	g pure	proper	water we	makes me
	impure	river water	method	are unable	answerable
	water	that	than	to use it	for the
	issues.	prevent	manual	efficiently	health and
		major and	practices	because it	Risk factors

		minor	or can't	creates	that the
		health	find an apt	major and	villagers
		issues in	product.	minor	take.
		people.		health	
				issues to	
				villagers.	
PS-2	I'm an	I'm	But often	Since use	It makes
	farmer.	developing	get	Of fertizliers	me to feel
		food and	disappointe	Itself	the
		Forage	d due to	produce	clueless
		crops.	chemical	necessary	about my
			imbalance	growth in	Farming
			in the water	crops the	technique
			Supply from	untreated	s and
			river.	river water	survival.
				Creates	
				decay of	
				crops which	
				goes to	

3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Water is a finite resource that is necessary for agriculture, industry and the survival of all living things on the planet, including humans. Many people are unaware of the need of drinking adequate amounts of water on a daily basis. Many unregulated methods waste more water. Poor water allocation, inefficient consumption, lack of competent and integrated water management are all factors that contribute to this problem. Therefore, efficient use and water monitoring are potential constraint for home or office water management system.
2.	Idea / Solution description	The solution to this problem is, to monitor the river water quality for the need of safe drinking water
3.	Novelty / Uniqueness	The uniqueness is to obtain the water monitoring system with high frequency, high mobility, and low powered. Therefore, our proposed system will immensely help Bangladeshi populations to become conscious against contaminated water as well as to stop polluting the water.
4.	Social Impact / Customer Satisfaction	Using this application, we can track the contents in river water to make sure that the water is in safe limit for utilizing for general purpose on living things
5.	Business Model (Revenue Model)	Current water quality monitoring system is a manual system with a monotonous process and is very time-consuming. The system consists of several sensors which is used to measure physical and chemical parameters of the water. With this more money can be saved.
6.	Scalability of the Solution	This system proposes a sensor based water quality monitoring system, consists of several factors which is used to measure physical and chemical factors of the water.

3.4 PROBLEM SOLUTION FIT



4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Users Authorization levels	Complete mapping are given in a hierarchical manner in order to show only the specific Data.
FR-2	Historical Data	The Data are stored in the cloud from the beginning Stage till the Updation .
FR-3	User Authentication	The credentials is accessible only to the authorized users to access the model.
FR-4	Users rules and laws	There is some specific guidelines which has to be followed by the users.

4.2NON FUNCTIONAL REQUIREMENT

Non-functional Requirements:

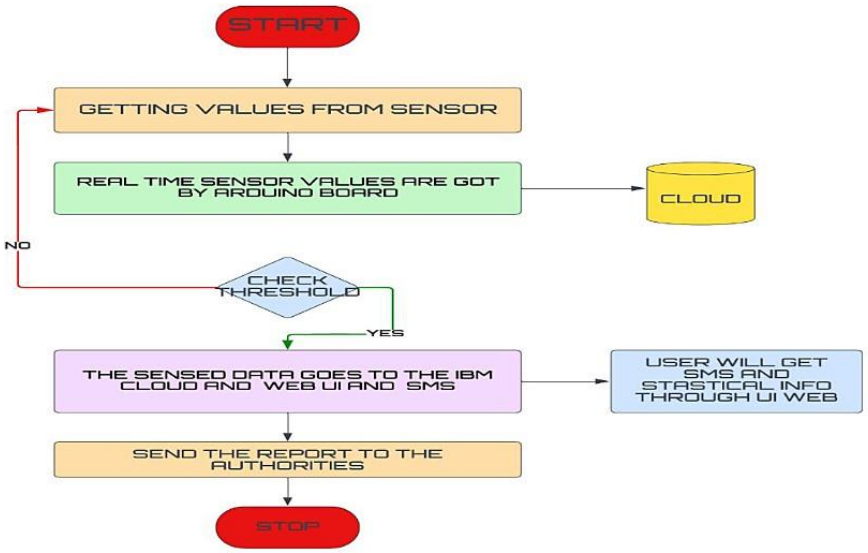
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The Final data should be easily understandable.
NFR-2	**Security**	The model are designed in a secured manner in order to maintain the privacy
NFR-3	**Reliability**	Even if there is a firmware issues (failures) the last updated Data's are stored in a Default manner.
NFR-4	**Performance**	High quality sensors are used to ease the customer's work.
NFR-5	**Availability**	The model are designed in such a way that are available ,usable and can be modified anytime.
NFR-6	**Scalability**	The System are Scaled according to the size of the water body (varies)

5. PROJECT DESIGN

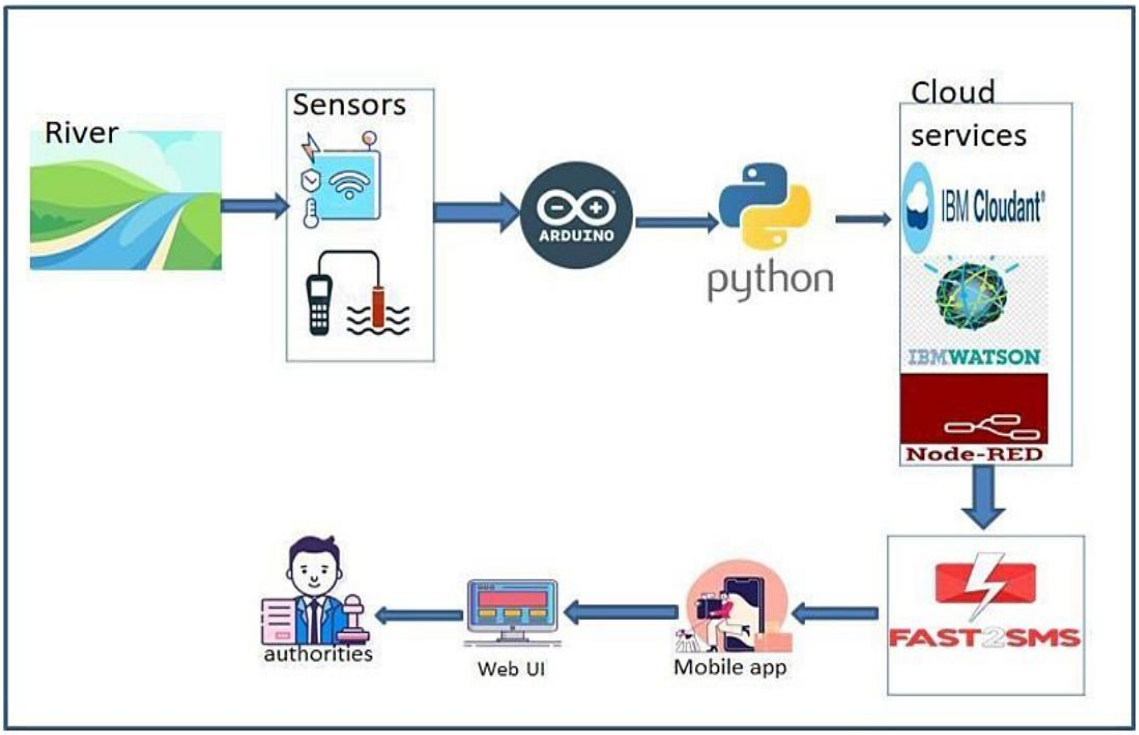
5.1 DATA FLOW DIAGRAMS

Data Flow Diagram:

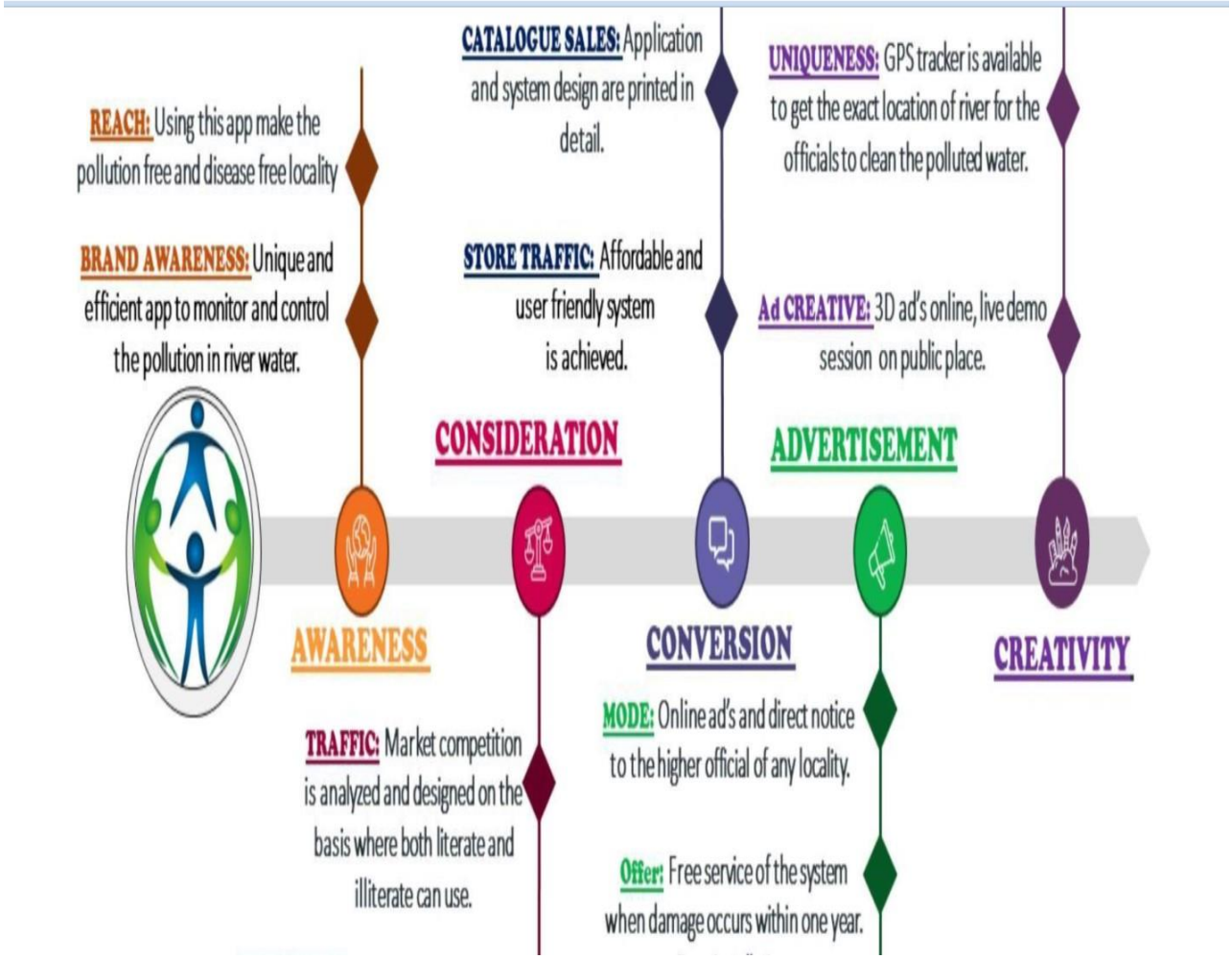


5.2 TECHNOLOGY ARCHITECTURE

Technical Architecture:



5.3 USER STORIES



6.PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, and password, and confirming my password.	2	High	Sowmiya.R
Sprint-1		USN-2	As a user, I will receive a confirmation email once I have registered for the application	1	High	Sowmiya. P
Sprint-2		USN-3	As a user, I can register for the application through Facebook	2	Low	Shanmuga Priya. V
Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Medium	Roshini. C
Sprint-1	Login	USN-5	As a user, I can log into the application by Entering email & password	1	High	Sowmiya.R

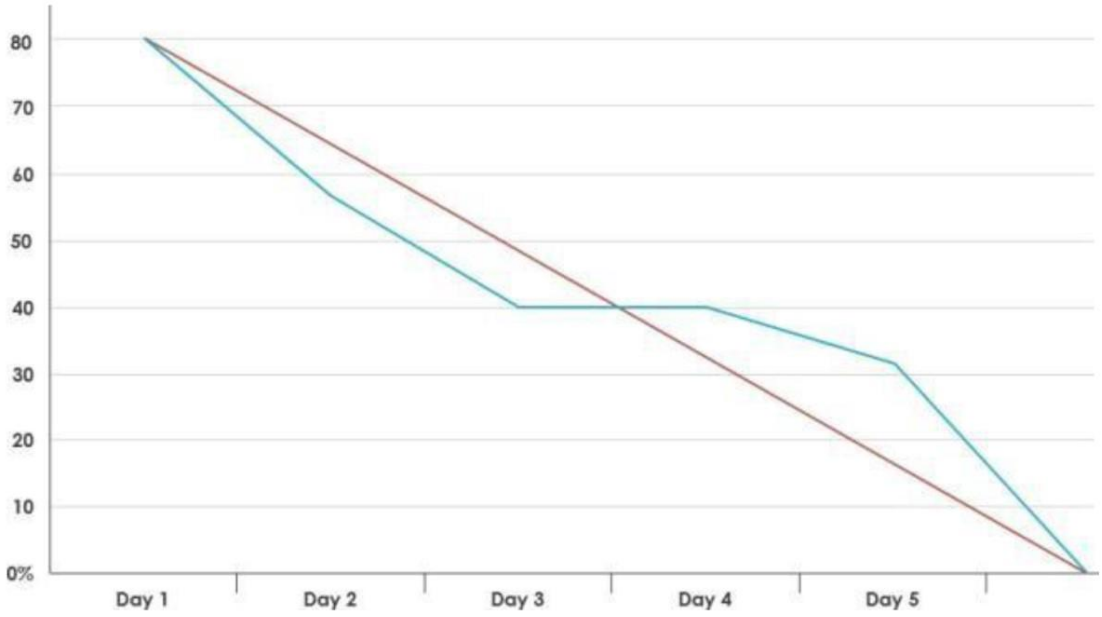
Project Tracker, Velocity & Burndown Chart: (4 Marks)

Sprint	Total Story Points	Duration	Sprint StartDate	Sprint End Date(Planned)	Story Points Completed (as Planned End Date)	Sprint ReleaseDate (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	30	30 Oct 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	49	06 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	50	07 Nov 2022

Velocity:

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

Burndown Chart:



6.2 SPRINT DELIVERY SCHEDULE

SI. NO	ACTIVITY TITLE	ACTIVITY DESCRIPTION	DURATION
1.	Understanding the project requirement	Assign the team members and create a repository in the Git hub, Assign the task to each member and teach how to use and open and class the GitHub and IBM career education	1 WEEK
2.	Starting of project	Advise students to attend classes of IBM portals, create and develop a rough diagram based on project description and gather information on IOT and IBM projects and team leaders assign tasks to each member	1 WEEK
3.	Attend class	Team members and team lead must watch and learn from classes provided by IBM and NALAYATHIRAN and must gain access of MIT license for their project.	4 WEEKS

4.	Budget and scope of the project	Budget and analyze the use of IoT in the project and discuss with the team for budget prediction to predict the favorability for the customer to buy	1 WEEK

7.CODING AND SOLUTIONING

```
#include <LiquidCrystal.h> LiquidCrystal

1cd(5,6,8,9,10,11);

int red1ed = 2;

 int green1ed = 3;

 int buzzer = 4;

int sensor = A0;

 int sensorThresh = 400;

 void setup()
```

```
{
 pinMode(red1ed, OUTPUT);
 pinMode(green1ed,OUTPUT);
 pinMode(buzzer,OUTPUT); pinMode(sensor,INPUT);
 serial.begin(9600); 1cd.begin(16,2);
 }

 Void loop()
 {
     int analogValue = analogRead(sensor); Serial.print(analogvalue);
     if(analogValue>sensorThresh)
     {
digitalWrite(red1ed,HIGH); digit1Weite(green1ed,LOW);
        tone(buzzer,1000,10000); 1cd.clear(); 1cd.setCursor(0,1);
        1cd.print("MONITORING"); delay(1000);
       1cd.clear();
       1cd.setCursor(0,1);
```

```
    1cd.print(“EVACUATE”); delay(1000);
}

else
```

```
  {

        digitalWrite(greenlad,HIGH);

        digitalWrite(red1ed,LOW); noTone(buzzer);

        1cd.clear();

        1cd.setCursor(0,0);

        1cd.print("SAFE");

        delay(1000);  1cd.clear();

        1cd.setCursor(0,1);
       1cd.print("ALL CLEAR"); delay(1000);

    }
}
```

ADVANTAGES:

Advantages are **more user friendly, efficient.**

DISADVANTAGES:

Drawback is high cost for smart sensors.