Adithya Institute of Technology

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PROJECT REPORT

TITLE –REAL TIME RIVER WATER QUALITY MONITORING AND CONTROL SYSTEM

TEAM ID: PNT2022TMID42308

TEAM MEMBERS

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PLACE:

HOD MENTOR

ABSTRACT

There is need for effective monitoring, evaluation and control of water quality in different areas. Ensuring safe water supply of drinking water is big challenge for today's generation. The excessive use of fertilizers in farms and also in other sectors such as mining and construction have contributed in overall reduction of water quality. To ensure the safe supply of the drinking water the quality needs to be monitor. So we can give a design and development of a low cost system for real time monitoring of the water quality using IoT(Internet of Things) and machine learning. The system include of different sensors is used for measuring physical and chemical parameters of the water.

INTRODUCTION

PROJECT OVERVIEW:

We depict the design of Wireless Sensor Network (WSN) that assists to monitor the quality ofwater with the support of information sensed by the sensors dipped in water.Using different sensors, this system cancollect various parameters from water, suchas pH, dissolved oxygen, turbidity, conductivity, temperature, and so on.The rapid development of WSN technology provides a novel approach to realtime data acquisition, transmission,and processing.The clients can get ongoing water quality information from faraway.Now a day's Internet of things (IoT) is an innovative technologicalphenomenon.It is shaping today's world and is used in different fields for collecting, monitoring and analysis of data from remote locations. IoT integratednetwork if everywhere starting from smart cities,smart power grids, and smart supply chain to smart wearable. Though IoT is still under applied in the field of environment it has huge potential.It can be applied to detectforest fire and early earthquake,reduce air population, monitor snow level, prevent landslide, and avalanche etc. Moreover, it can be implemented in field of water quality monitoring and controlling system .Water quality monitoring has gained more interest among researchers in this twentyfirst century. Numerousworks are either done or ongoing in this topic focusing on various aspects of it. The key theme of all the projects wasto develop an efficient, costeffective, realtime waterquality monitoring system which will integrate wireless sensornetwork and internet of things [14]. In this research,we monitor the physical and chemical parameters of water bodies inside Chittagong city by using an IoT based sensor network

PURPOSE

The main aim is to develop a system for continuous monitoring of river water quality at remote places usingwireless sensor networks with low power consumption, lowcost and high detection accuracy.Water quality monitoring has gained more interest among researchers in this twentyfirst century.Numerousworks are either done or ongoing in this topic focusing on various aspects of it.The key theme of all the projects wasto develop an efficient,costeffective, realtimewater quality monitoring system which will integrate wireless sensornetwork and 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

LITERATURE SURVEY

EXISTING PROBLEM :

S.NO	Paper	Author	Year	Method And Algorithm
1	IoT Based Realtime River Water Quality Monitoring System	Mohammad Salah Uddin Chowdurya†, Talha Bin Emranb†, Subhasish Ghosha†, Abhijit Pathaka†, Mohd. Manjur Alama, Nurul Absara, Karl Anderssonc, Mohammad Shahadat Hossain	2019	Current water quality monitoring system is a manual system with a monotonous process and is very timeconsuming. This paper proposes a sensorbased 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. Realtime 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	Real Time Water Quality Monitoring System	Mithila Barabde1, Shruti Danve	2015	Water pollution is one of the biggest fears for the green globalization. To prevent the water pollution, first we have to estimate the water parameters like pH, turbidity, conductivity etc, as the variations in the values of these

				parameters point towards the presence of pollutants. At present, water parameters are detected by chemical test or laboratory test, where the testing equipments are stationary and samples are provided to testing equipments. Thus the current water quality monitoring system is a manual system with tedious process and is very time consuming. In order to increase the frequency, the testing equipments can be placed in the river water and detection of pollution can be made remotely. This paper proposes a Sensor -Based Water Quality Monitoring System. The system architecture consists of data monitoring nodes, a base station and a remote station. All these stations are connected using wireless communication link. The data from nodes is send to the base station consisting of ARM controller designed for special compact space application. Data collected by the base station such as pH, turbidity, conductivity, etc is sent to the remote monitoring station. Data collected at the remote site can be displayed in visual format on a server PC with the help of MATLAB and is also compared with standard values. If the obtained 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.
3	Cost - Effective River Water Quality Managemen t using Integrated Real -Time Control Technology	Fanlin Meng,† Guangtao Fu, * ,† and David Butler * , †	2017	Integrated real -time control (RTC) of urban wastewater systems is increasingly presented as a promising and emerging strategy to deliver improved surface water quality by responsive operation according to real -time data collected from the sewer system, treatment plant, and the receiving water. However, the detailed benefits and costs associated with integrated RTC have yet to be comprehensively evaluated. Built on state-of-the-art modeling and analytical tools, a three-step framework is proposed to develop

				integrated RTC strategies which cost-effectively maximize environmental outcomes. Results from a case study show integrated RTC can improve river quality by over 20% to meet the "good status" requirements of the EU Water Framework Directive with a 15% reduced cost, due to responsive aeration with changing environmental assimilation capacity. The costeffectiveness of integrated RTC strategies is further demonstrated against tightening environmental standards (to the strictest levels) and against two commonly used compliance strategies. Compared to current practices (seasonal/monthly based operation), integrated RTC Strategies.
4	Water quality monitoring in smart city: A pilot project	Yiheng Chen ∗, Dawei Han	2018	A smart city is an urban development vision to integrate multiple information and communication technology (ICT), "Big Data" and Internet of Things (IoT) solutions in a secure fashion to manage a city's assets for sustainability, resilience and liveability. Meanwhile, water quality monitoring has been evolving to the latest wireless sensor network (WSN) based solutions in recent decades. This paper presents a multi -parameter water quality monitoring system of Bristol Floating Harbour which has successfully demonstrated the feasibility of collecting real -time high -frequency water quality data and displayed the real -time data online. The smart city infrastructure – Bristol Is Open was utilised to provide a plug & play platform for the monitoring system. This new system demonstrates how a future smart city can build the environment monitoring system benefited by the wireless network covering the urban area. The system can be further integrated in the urban water management system to achieve improved efficiency.
5	Water Quality Monitoring	Shruti Sridharn	2014	The parameters involved in the water quality monitoring such as the pH level, turbidity and temperature is measured in real time by the

	System Using Wireless Sensor Network.			sensors that send the data to the base station or control/monitoring room. As the monitoring is intended to be carried out in a remote area with limited access, signal or data from the sensor unit will then be transmitted wirelessly to the base monitoring station. The application of wireless sensor network (WSN) for a water quality monitoring is composed of a number of sensor nodes with networking capability. Such monitoring system can be setup emphasizing on the aspects of low cost, easy ad hoc installation, easy handling and maintenance. The use of wireless system for monitoring purpose will not only reduce the overall monitoring system cost in terms of facilities setup and labor cost, but will also provide flexibility in terms of distance or location. In this paper, the fundamental design and implementation of WSN featuring a high power transmission Zigbee based technology together with the IEEE 802.15.4 compatible transceiver is proposed. It is chosen due to its features that fulfill the requirement for a low cost, easy to use, minimal power consumption and reliable data communication between sensor nodes. The development of graphical user interface (GUI) for the monitoring purposes at the base monitoring station is another main component discussed in this paper. The GUI should be able to display the parameters being monitored continuously in real time. The developed GUI platform using MATLAB is costeffective and allows easy customization.

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PROBLEM STATEMENT DEFINITION:

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 system consists of several sensors which is used to measure physical and chemical parameters of the water. 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.

IDEATION AND PROPOSED SOLUTION

EMPATHY MAP CANVAS:

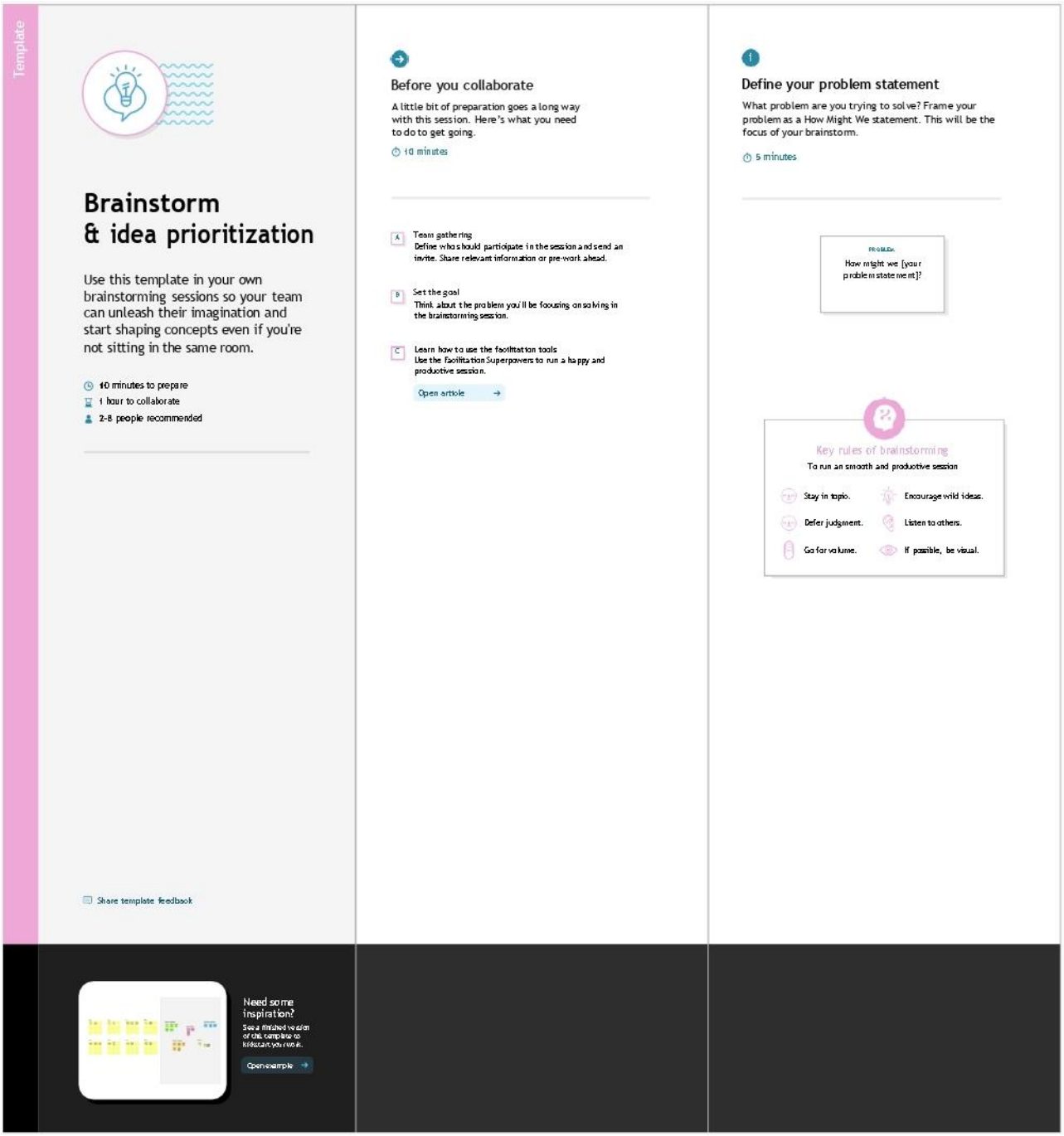
An empathy map is a collaborative tool teams can use **to gain a deeper insight into their customers**. Much like a user persona, an empathy map can represent a group of users, such as a customer segment.It is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes. It is a useful tool to helps teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

IDEATION & BRAINSTORMING:

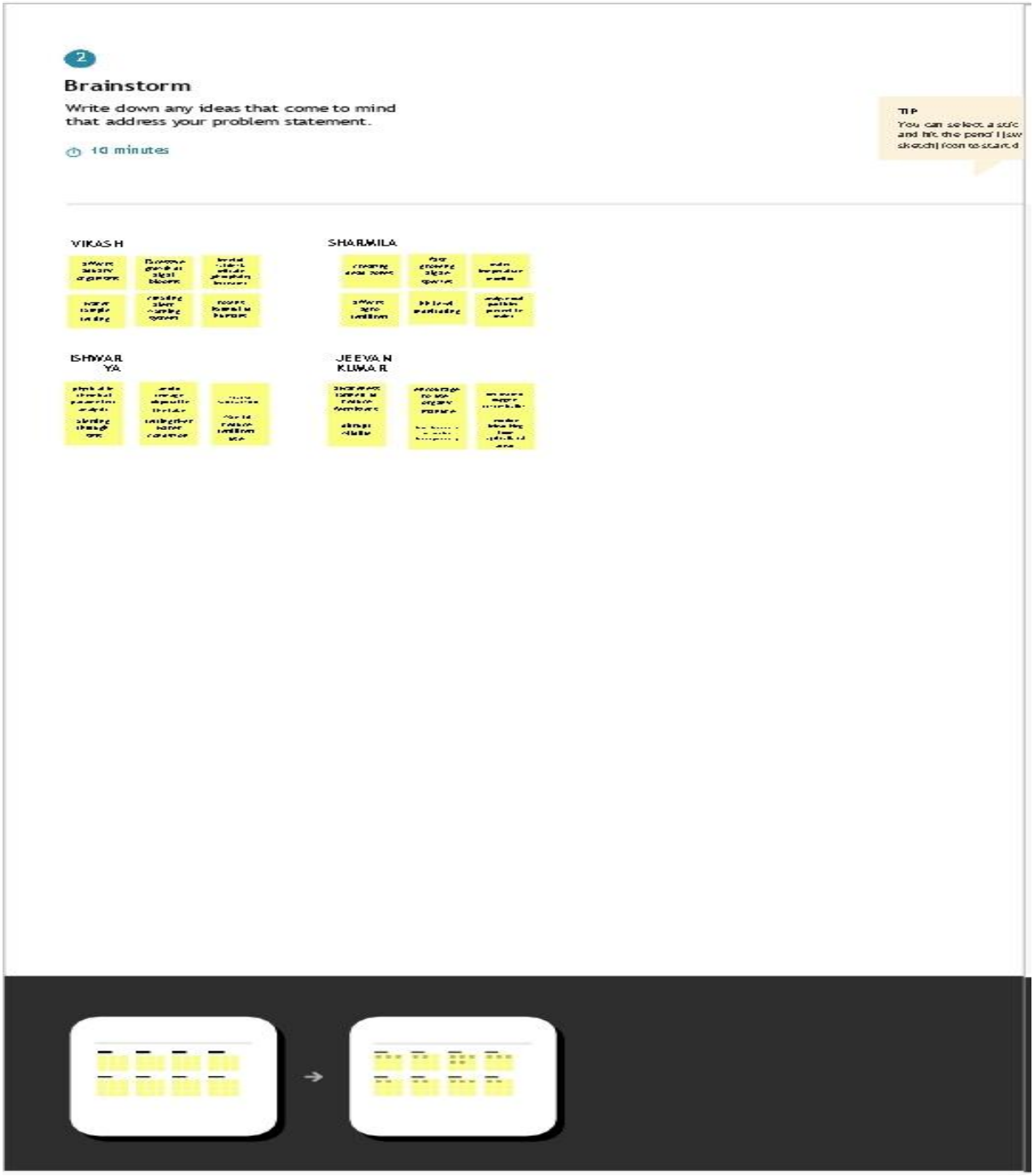
Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are

welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

Step-1: Problem Statement.



Step-2: Brainstorm, Idea Listing and Grouping.

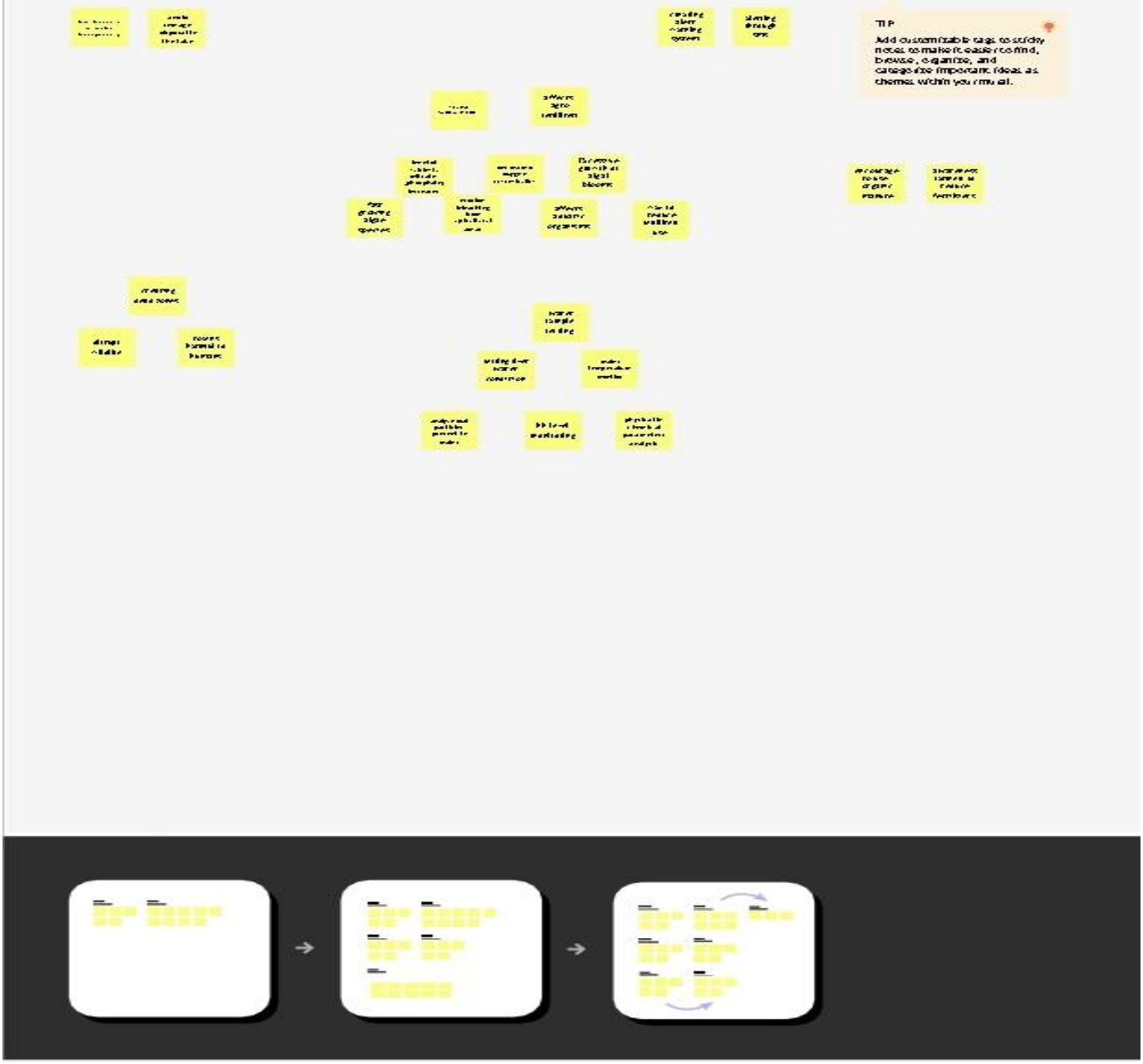


3

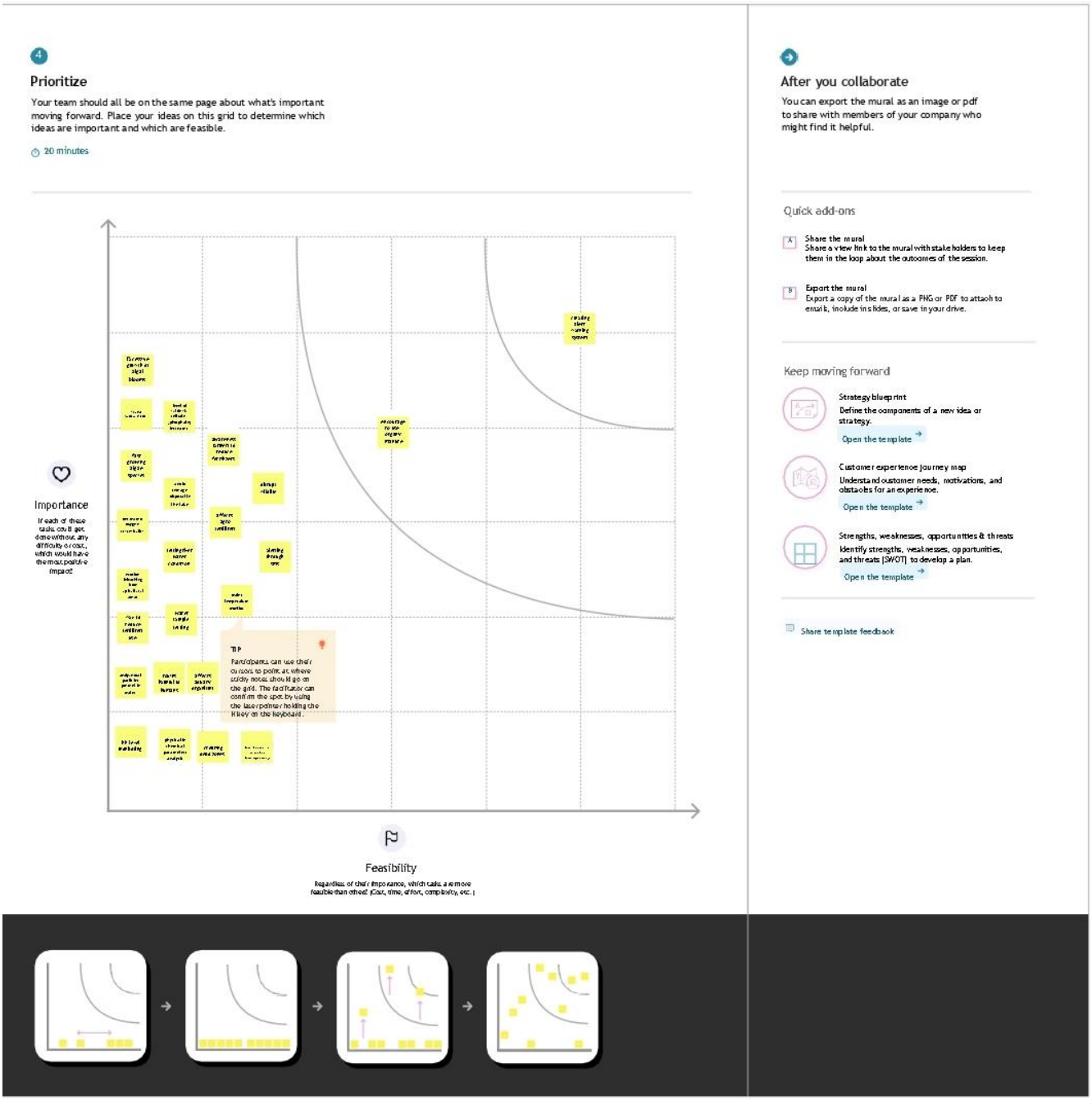
Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes



Step-3: Idea Prioritization



PROPOSED SOLUTION:

S .No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Massive growth of algae called eutrophication leads to pollution(monitoring and controlling the Quality of river water)
2.	Idea/Solution description	Detecting the dust particles , PH level of water, Dissolved oxygen and temperature to be monitored and altering the authorities if water quality is not good.
3.	Novelty/Uniqueness	River water quality can be monitored by web application. Quality parameter will track continuously with Standard measurements.
4.	Social Impact/ Customer Satisfaction	Localities will not get suffered by poor quality of water by alerting them when the water quality is not good.
5.	Business Model(Revenue Model)	Water quality monitoring system by aeron systems for industrial water treatment plant, river bodies, aqua forming ,digital loggers.
6.	Scalability of the Solution	Measuring of real time values and continuous monitoring helps in maintaining the quality of water.

I am	Common people living a normal lifeon Earth	Common people living on Earth who consume water in their day-to-day life for different purpose
I’m trying to	Monitor the quality of the water	Wants to monitor the water consumed everyday whether the water is contaminated or pure, pH, temperature, salinity in it
but	Do not know to monitor the quality of water	Time consuming process for manual testing
because	Lack of required knowledge	Common people lack knowledge of this type of testing, sensors etc.
Which makes me feel	Doubted and fearful of the consumed water	Decline of pure water, increasing viral diseases

PROBLEM SOLUTION:

REQUIREMENT ANALYSIS

FUNCTIONAL REQUIREMENT:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Email Registration through product mobile UI
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	PH level detection	To monitor the water quality PH sensor is used and the signals are sent to Arduino.
FR-4	Turbidity detection	Turbidity sensor TS-300B measures the clarity of element or muddiness utter in the water and the signals are send to Arduino.
FR-5	Ultrasonic generator	Waves are generated at regular interval times the to clear algae 25%,50%,100% .

NON-FUNCTIONAL REQUIREMENTS:

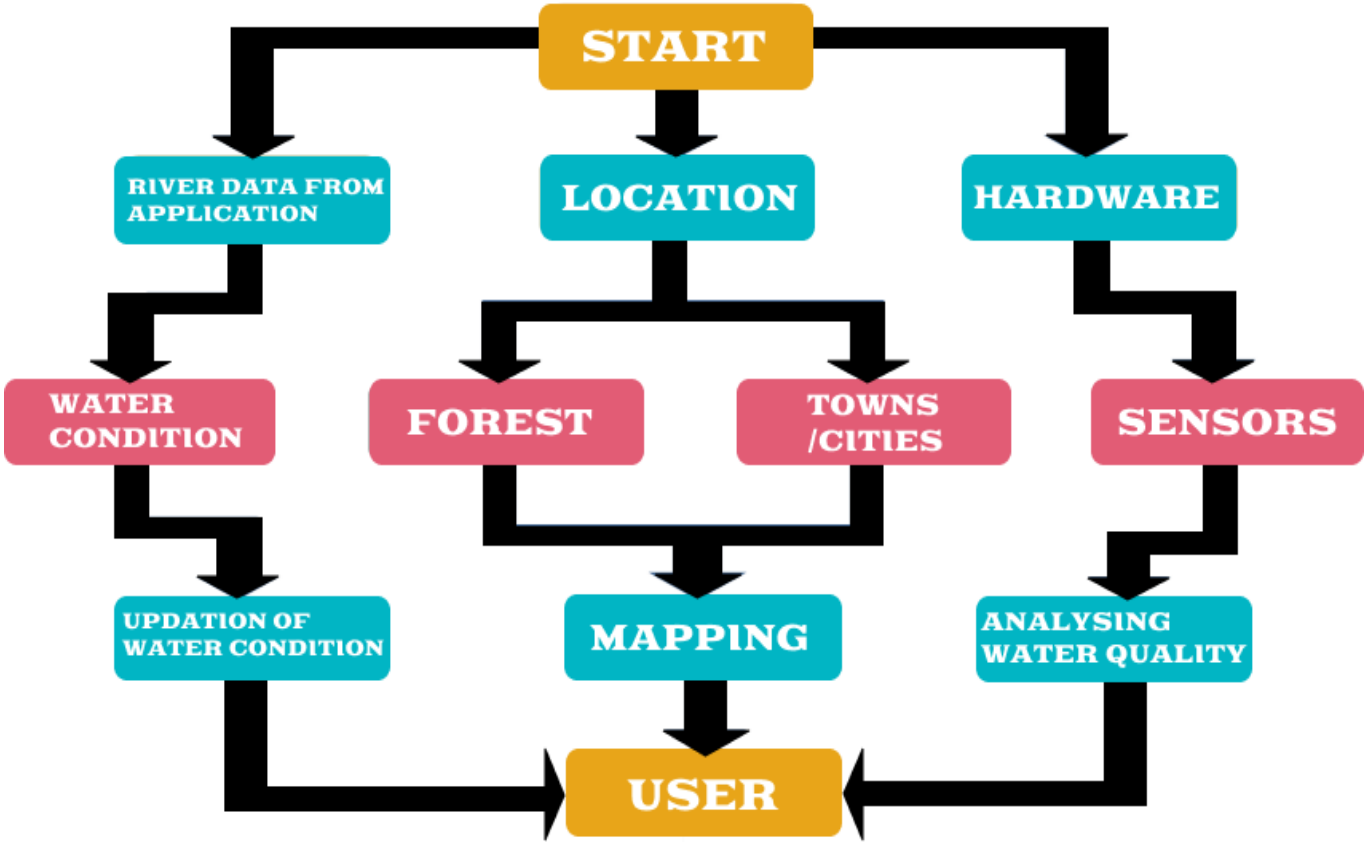
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	This Application/Device will be useful for literates/illiterates
NFR-2	Security	Data entered will be secured through data synchronization and it is secured by giving

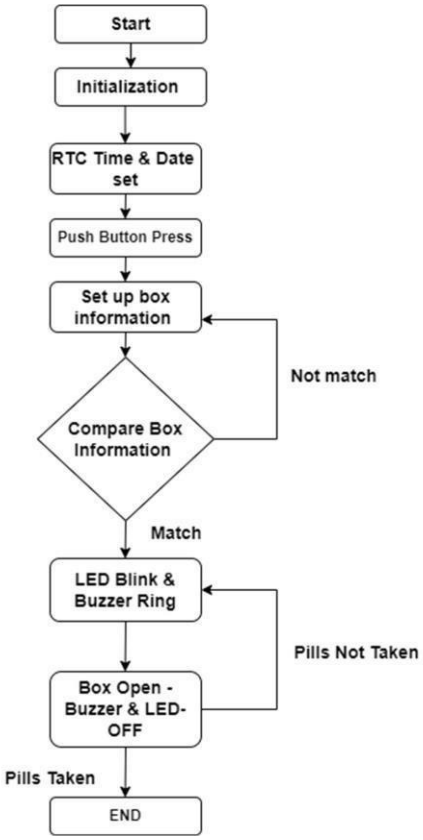
		username and password
NFR-3	Reliability	More reliable when compared with other Apps/Devices
NFR-4	Performance	Performance will be better and useful to the users compared to other products
NFR-5	Availability	Available on mobile app. Web version is getting ready for next release. Prototype is on-progress
NFR-6	Scalability	Once the data is uploaded, it won't be erased until the next data is uploaded

PROJECT DESIGN

DATA FLOW DIAGRAM



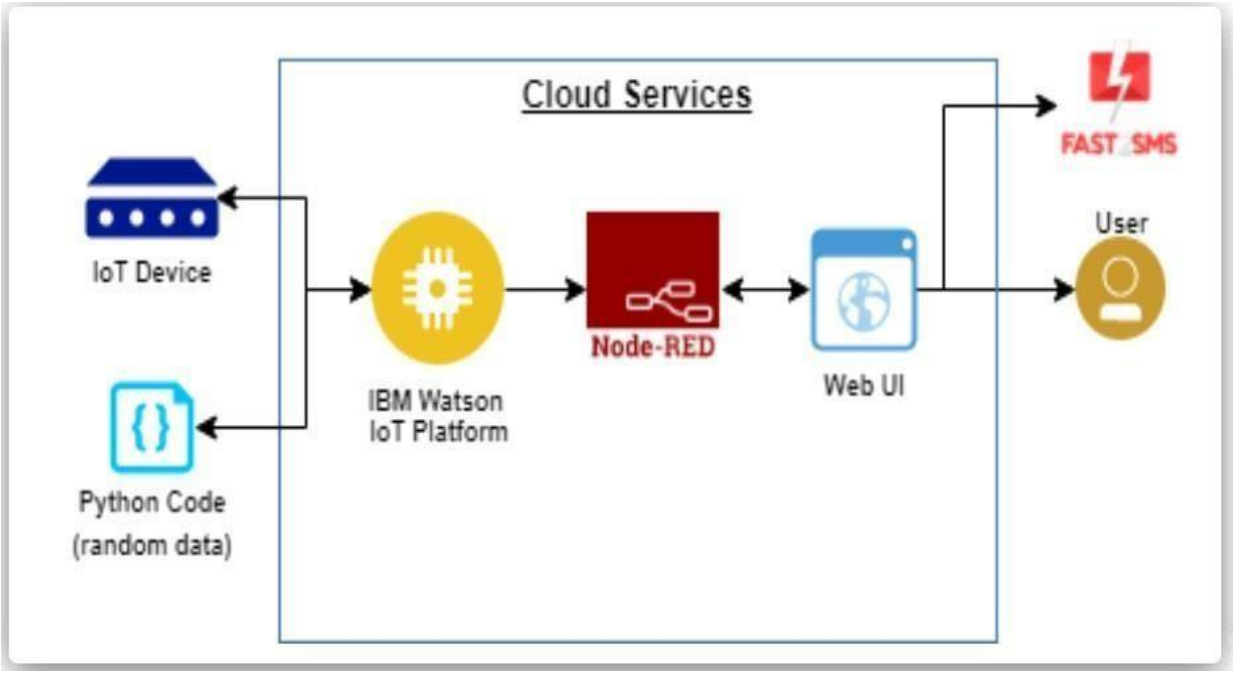
FLOW CHART:

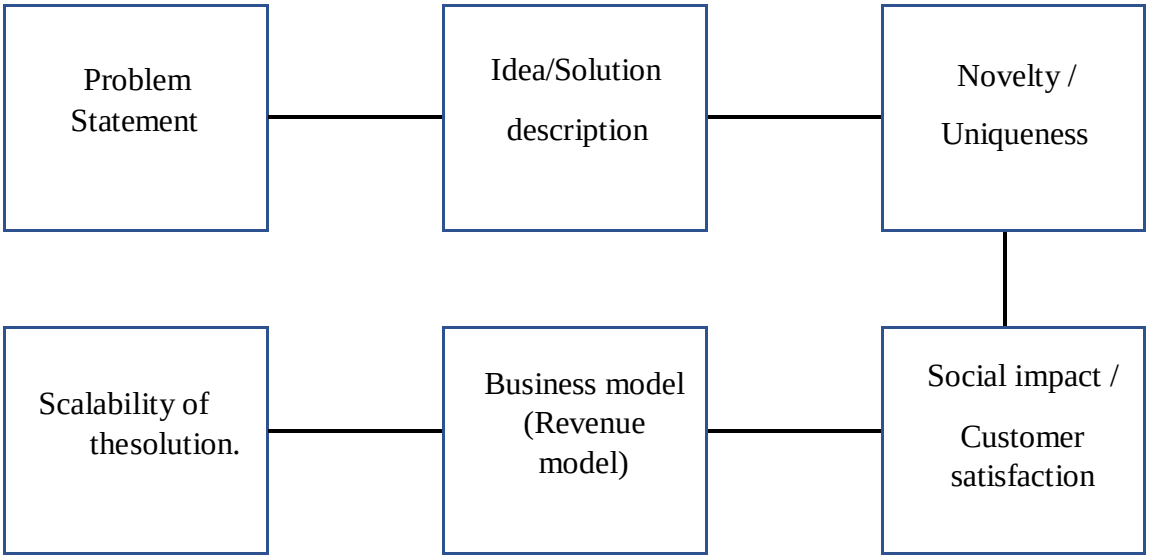


SOLUTION & TECHNICAL ARCHITECTURE:

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

SOLUTION ARCHITECTURE DIAGRAM:





USER STORIES:

WORKING

BENEFITS

OUTCOME

Info Transfer

An android application will be used to determine the sensor values and examined via cloud and warnings will be provided to user

The values are then compared with the threshold value

If the acquired value is above the SMS alert will be sent to the user

The data will be stored in the cloud or local storage will be implemented

Using the sensed parameters. the customer predicts the water quality

It proposed the system collects parameters of water pH, turbidity on the surface of water

With high speed from multiple different sensor nodes.

Mounted Sensors may get damage during natural disasters and often by aquatic animals

Customer can analyse data continually and instantly alert users to changes in the system.

It reduces the need for unreliable and expensive sampling.

It Can diminish the contaminants present in water

It changes to a drinking water

Using IoT integrated Big Data Analytics will immensely help people to become conscious against using contaminated water

The customer requires a low cost system

By the sensors, water contaminants must be detected.

It will immensely help customer to become conscious against using contaminated waste as well as to stop polluting the water.

The maintenance cost is also very high.

No need to compromise the water quality by the presence of infectious agents, toxic chemicals, and radiological hazards.

The related authorities can take measures to boost the water quality which makes it more usable for human purpose

It has high frequency, high mobility, and low powered.

It can be extended into an efficient water management system of a local area.

The issue is that the traditional method, such as workers, needs to go to each tank or river to collect data

It was satisfied by low-cost water quality monitoring system has been developed for large area of coverage

It was attributed to its long duration operation, flexibility, and reproducibility

To test other parameters ,the new sensors can be included.

The system has wide application and it is usable and affordable

PROJECT PLANNING & SCHEDULING

SPRINT PLANNING & ESTIMATION & DELIVERY SCHEDULING:

PROJECT PLANNING

Date	1 November 2022
Team ID	PNT2022TMID42308
Project Name	Project- Real Time River Quality Monitoring and Control System.
Maximum Marks	8 Marks

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

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User story Numb err	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, password, and confirming My password.	2	High	SHARMILA
	Registration via Facebook	USN-3	As a user, I can register for the application through Facebook	2	Low	
	Registration via Mail ID	USN-4	As a user, I can register for the application through Gmail	2	Medium	
Sprint-2	Confirmation	USN-2	As a user, I will receive confirmation email onceI have registered for the application	1	High	
	Login	USN-5	As a user, I can log into the application by entering email & password	1	High	
	IBM Cloud service Access		Get access to IBM cloud services.	2	High	
Sprint-3	Create the IBM Watson IoT and deviceSettings	USN-6	To create the IBM Watson IoT Platform and integrate the microcontroller with it, to send the sensed data on Cloud	2	High	SHARMILA, ISHWARYA, VIKASH
	Create a node red service	USN-7	To create a node red service to integrate the IBM Watson along with the Web UI	2	medium	VIKASH, JEEVAN KUMAR, SHARMILA
	Create a Web UI	USN-8	To create a Web UI, to access the data from the cloud And display all parameters.	2	Medium	ISHWARYA,
	To develop a Python code	USN-9	Create a python code to sense the physical quantity And store data.	2	Medium	VIKASH,

						JEEVAN KUMAR
	Publish Data to cloud.	USN-10	Publish Data that is sensed by the microcontroller to the Cloud	3	High	VIKASH
Sprint-4	Fast-SMS Service	USN-11	Use Fast SMS to send alert messages once the parameters like pH, Turbidity and temperature goes beyond the threshold	3	High	SHARMILA, VIKASH, JEEVAN KUMAR
	Testing	USN-12	Testing of project and final deliverables	3	Medium	

Project Tracker, Velocity & Burn down Chart: (4 Marks)

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date(Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	4 Days	24 Oct 2022	27 Oct 2022	20	29 Oct 2022
Sprint-2	20	5 Days	28 Oct 2022	01 Nov 2022	20	04 Nov 2022
Sprint-3	20	8 Days	02 Nov 2022	09 Nov 2022	20	11 Nov 2022
Sprint-4	20	9 Days	10 Nov 2022	18 Nov 2022	20	19 Nov 2022

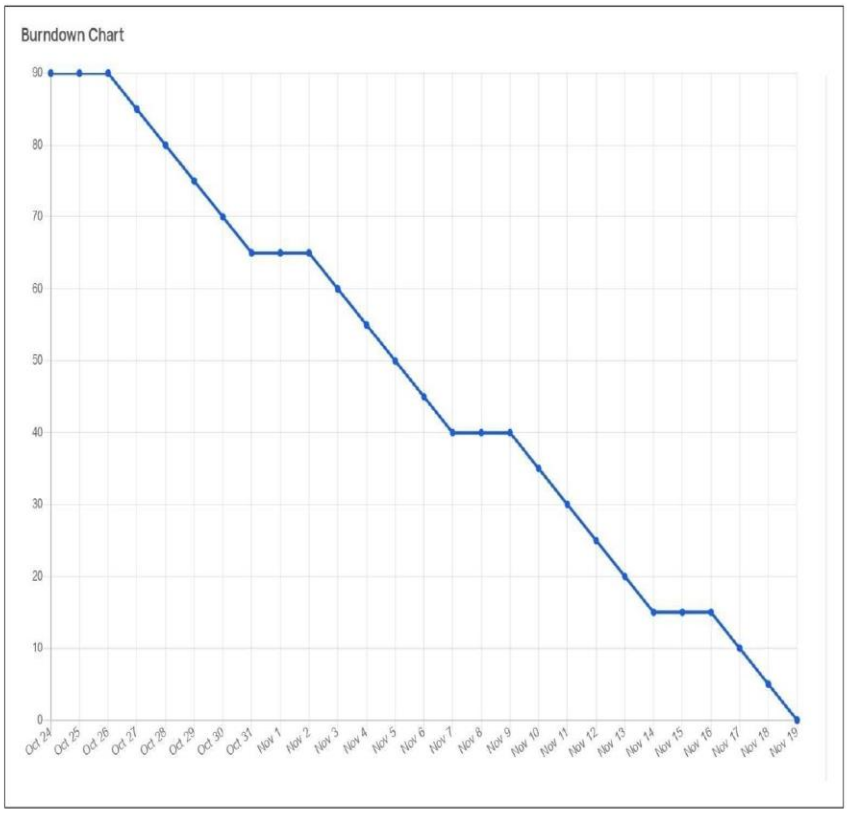
Velocity:

Imagine we have 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

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

Burndown Chart:

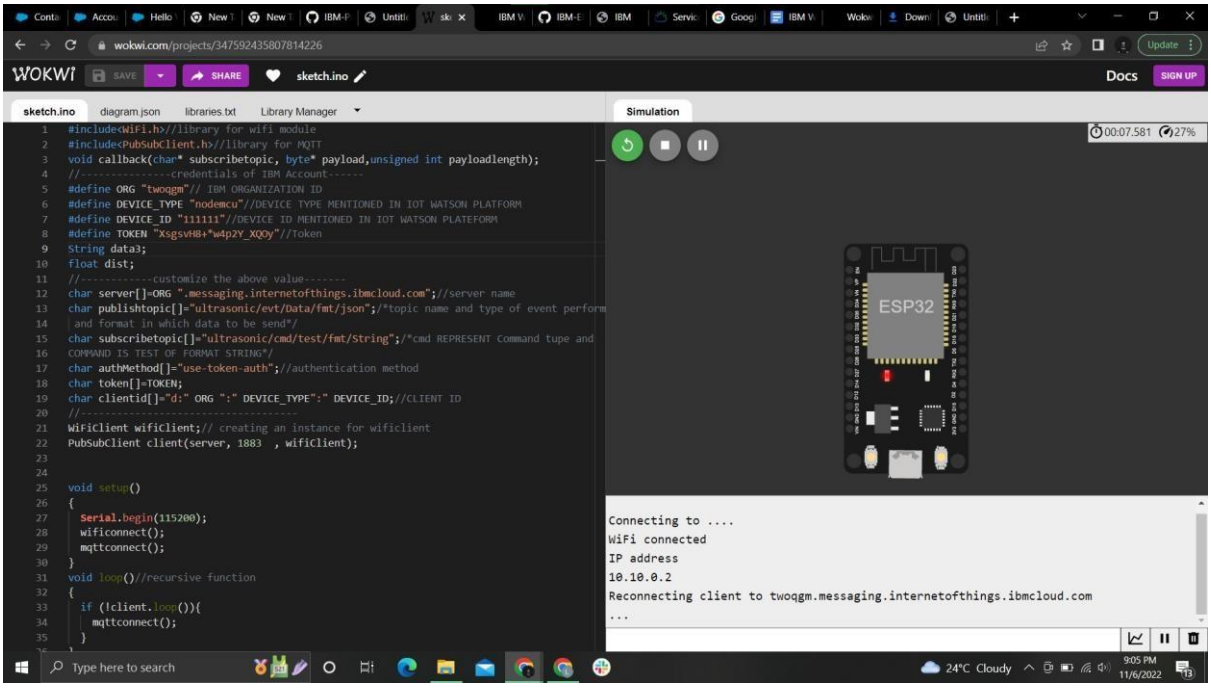
A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



CODING & SOLUTIONING

FEATURE 1:

Connected IBM Watson cloud with node MCU:



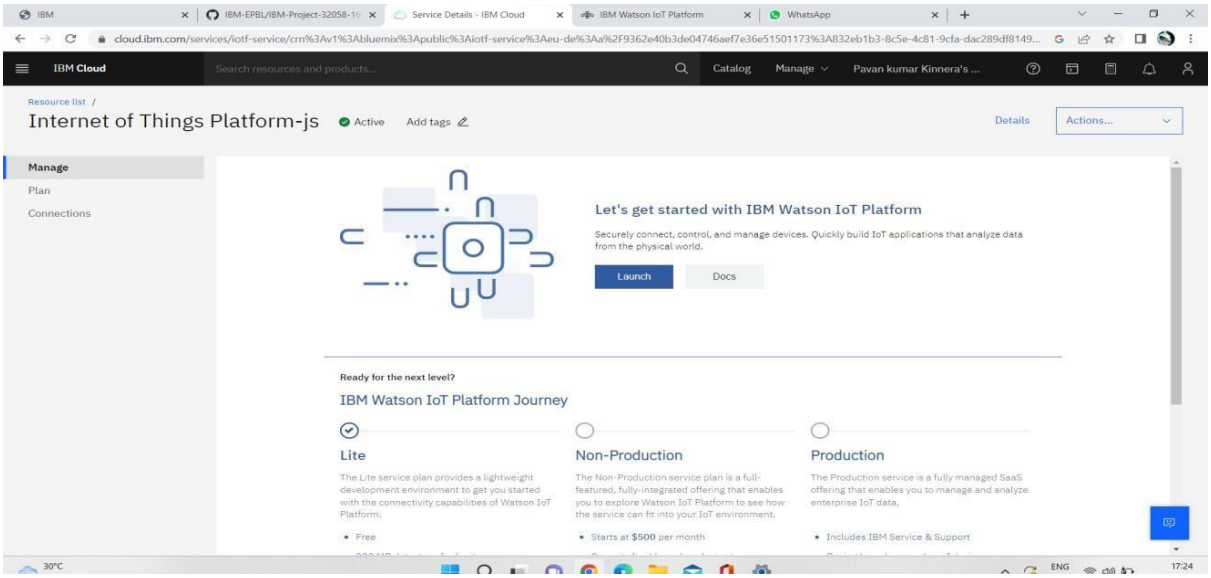
CODING:

```
#include<WiFi.h>//library for wifi module
#include<PubSubClient.h>//library for MQTT void
callback(char* subscribe topic, byte* payload, unsigned
int payload length);

//--------------credentials of IBM Account------

#define ORG "twoqgm"// IBM ORGANIZATION ID

#define  DEVICE_TYPE  "nodemcu"//DEVICE  TYPE
MENTIONED IN IOT WATSON PLATFORM

#define DEVICE_ID "111111"//DEVICE ID
MENTIONED IN IOT WATSON PLATEFORM

#define TOKEN
"XsgsvH8+*w4p2Y_XQO
y"//Token    String    data3;
float dist;

//------------customize the above value-----char
server[]=ORG
".messaging.internetofthings.ibmcloud.com";/
/server name char
publishtopic[]="ultrasonic/evt/Data/fmt/json"
; /*topic name and type of event perform and
format in which data to be send*/
```

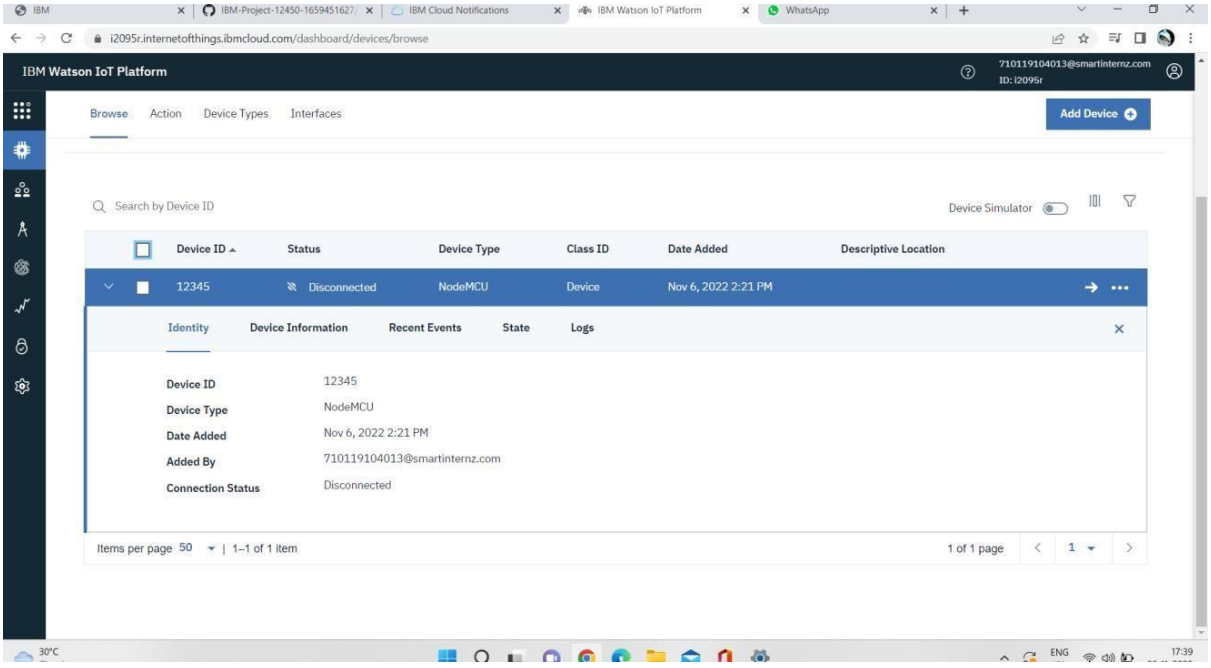
```
char
subscribetopic[]="ultrasonic/cmd/test/fmt/String";/*cm d
REPRESENT Command tupe and COMMAND IS
TEST OF FORMAT STRING*/

char authMethod[]="use-
tokenauth";//authentication method
char token[]=TOKEN; char
clientid[]="d:" ORG ":"
DEVICE_TYPE":"
DEVICE_ID;//CLIENT ID

//---------------------------------

WiFiClientwifiClient;// creating an
instance for wificlientPubSubClient
client(server, 1883 , wifiClient);


void setup()

{

 Serial.begin(11
 5200);
 wificonnect();
 mqttconnect();

} void loop()//recursive
function

{ if (!client.loop()){ mqttconnect();

 }
```

```
}
/*.....retrieving to cloud.....*/
void mqttconnect(){
 if(!client.connected()){
  Serial.print("Reconnecting client to ");
  Serial.print\n(server);
  while(!!!client.connect(clientid, authMethod, token)){
   Serial.print("."); delay(500);
  }
  initManagedDevice
  (); Serial.println();
 }
 else{
  Serial.println("Connected :)");
 }
} void wificonnect()//function definition for wificonnects
{
 Serial.println();
```

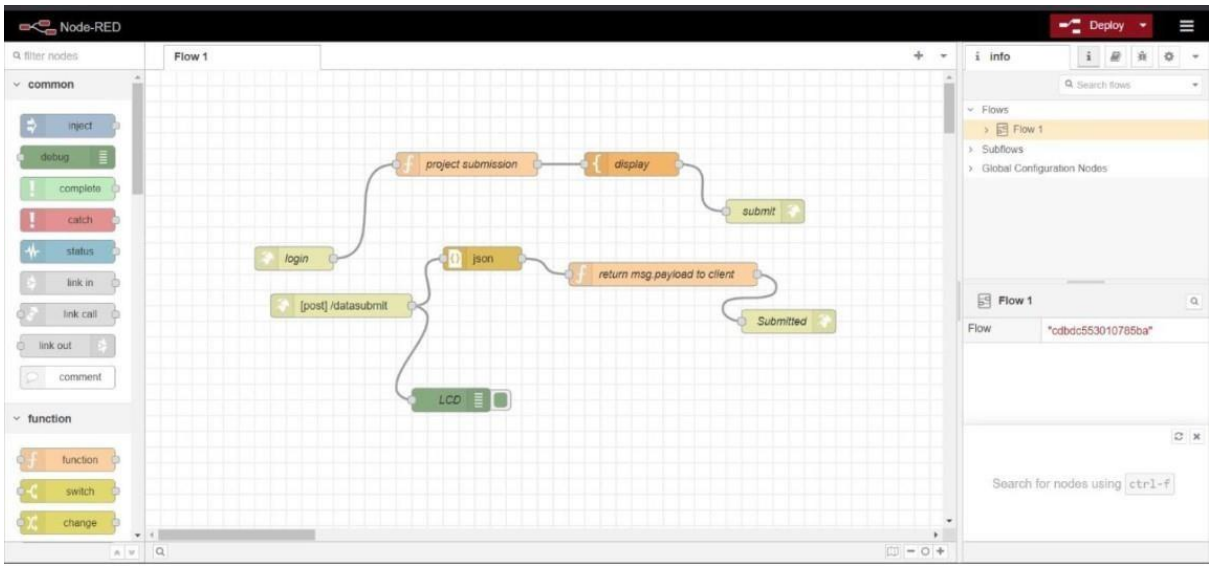
```
 Serial.print("Connecting to ");
 WiFi.begin("Wokwi-GUEST", "",6);//PASSING THE
 WIFI CREDIDENTIALS TO ESTABLISH
 CONNECTION while (WiFi.status()
 !=WL_CONNECTED){
  delay(500);
  Serial.print(".");
 }
 Serial.println("");
 Serial.println("WiFi connected");
 Serial.println("IP address");
 Serial.println(WiFi.localIP());
}                              void
initManagedDevice(){
 if(client.subscribe(subscribetopic)){
  Serial.println((subscribetopic));
  Serial.println("subscribe to cmd OK");
 }else{
  Serial.println("subscribe to cmd failed"); }
}
```



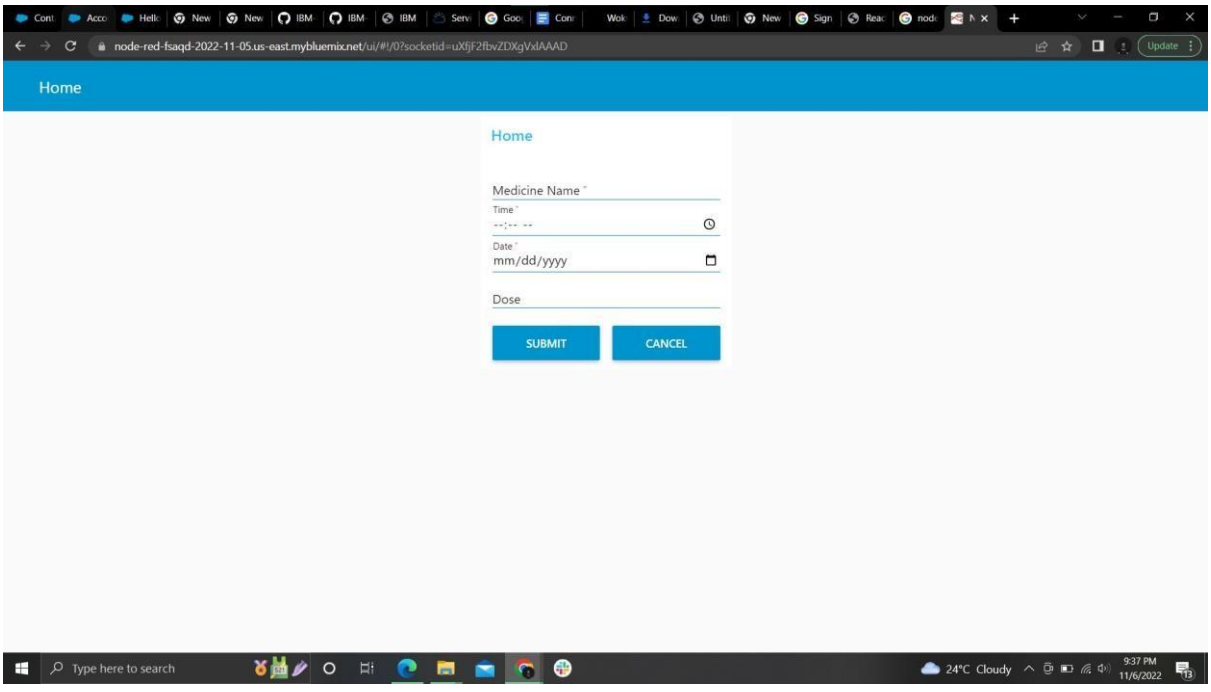
ADD A DEVICE:



FEATURE 2:



Created user input form in node-red



RESULT

The study found that thinking has moved on from a focus on the problems of accessing services to exploring ways in which they may function in an integrated way. The study shows how thinking on integrated care for older people has developed, and knowledge of micro, mezzo and macro strategies is now more available.

With the continuously increasing utilization of internet in this point in time, this assignment paintings has been engaged to execute a framework depending on web innovation which could discuss through internet for health checking of patients and for giving assist to vintage people. This paper provides shape and operating of an IOT based totally Personal Assistance Device which is a helpful device using low force Atmega328 microcontroller and ESP8266. In this paintings, accelerometer is utilized to apprehend the development of patient even though heart beat sensor module supply pulse of patient that is ship to microcontroller unit which sends this statistics to everything communicate producer to reveal the readings using ESP8266 Wi-Fi conference. During the crisis situations, a caution might be raised over the internet level telling the expert/overseer by way of the patient simply by squeezing a seize in the helpful machine. This offers a

trustworthy framework which can screen the well-being reputation continuously of a patient or an vintage individual.

CONCLUSION

GitHub & PROJECT DEMO LINK:

https://github.com/IBM-EPBL/IBM-Project-32058-1660207867

https://drive.google.com/file/d/156EHvwXrldx7VCC39KPOasvtxIPqxMPw/view?usp=drivesdk