TABLE OF CONTENTS

1.INTRODUCTION

1.1 PROJECT OVERVIEW

- Ever increasing population, urbanization and modernization are posing problems of sewage disposal andcontamination of surface waters like lakes. Natural water gets contaminated due to weathering of rocks, leachingof soils and mining processing, etc.

- Various types of problems in lake which cause nutrient enrichment in lake have been reviewed. Land use changeandlonger growing seasons could increase the use of fertilizers with subsequent leaching to watercourses, rivers and lakes, increasing therisk of eutrophication and loss of biodiversity.

- Water quality can be assessed by various parameters suchasBOD, temperature, electrical conductivity, nitrate, phosphorus, potassium, dissolved oxygen, etc. Heavy metals such as Pb, Cr, Fe, Hg, etc. are of special concern because they produce water orchronic poisoning in aquatic animals.

- Harmful algal blooms are becoming increasingly common in freshwater ecosystems globally.

- Pollutionby plastic debris is an increasing environmental concern inwater bodies, where it affects open-water, shoreline andbenthic environments.

- Surface water densities of plastics are as high as those reported for areas of litter accumulationwithin oceanic gyres.

- Different methods have been used to analyse the water qualityoflake such as Hyperion, water quality index and hazardquotient. Itis recommended that pollution prevention and water re-useshould be adopted in combination with the recycling of nutrientsin controlled urban

- Regularly monitoring water quality is a crucial part ofidentifying any existing problems, or any issues that could emerge in the future.

- For example, data has been used to reveal that over the past few years, increases in fertilisers used for food production had increased global nitrogen pollution in rivers by up to 20%.

1.2 PURPOSE

- When designing and developing pollution prevention and management strategies data collected from water quality monitoring efforts is hugely helpful.

- With 70% of untreated industrial waste dumped straight into water systems, pollution management is a must.

- Today governments, communities and businesses are required to meet a range of water quality goals.

- Monitoring data is used to determine whether or not pollution regulations are being complied with.

- Results are used to pinpoint any changes or trends that appear in water bodies over a period of time. These can be short of long termdevelopments.

2.LITERARY SURVEY

2.1 EXISTING PROBLEM

- The Common Challenges faced during the river water quality monitoring are

  - Technical Hurdles
  - Human Resource
  - Manual Processes
  - Storage and Transportation Issues
  - Lack Of Technology

Conclusion: Eutrophication as well as presence of toxic

- Dinoflagellates and Cyanophyceae in the tidal creek of Sundarban

estuary definitely revealed the deteriorated status of the water quality.

- The structure and function of the mangrove food web is unique, driven

by both marine and terrestrial components. But little attention has

been paid so far to the adaptive responses of mangrove biota to the

various disturbances, and now our work unfolds the fact that marine

status of Sundarban estuary is highly threatened which in turn will

affect the ecology of the mangrove.

- This study indicates that ecosystem dynamics of the world heritage site Sundarban may facilitate bioinvasion putting a question mark on the sustainability of mangroves.

IoT Based Real-time River Water Quality Monitoring System

Mohammad Salah UddinChowdury, Talha BinEmran, Science Direct – **2018**

This paper proposes a sensor-based water quality monitoring system. The main components of Wireless Sensor Network (WSN) include amicrocontroller 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.

Review of Water Quality Monitoring using

Internet of Things (IoT)

Mr. A. P. Roger Rozario, R. Surya IEEE, 2019

The quality of the water must be monitored in real-time to ensure its

safety and supply. Monitoring water in traditional ways takes longer,

which can take up to from 24 to 96 hours to identify contaminants in

water supplies, which are more time taking. This project aims at developing a water quality monitoring system using sensors and IoT (Internet of Things).

The water quality parameters like temperature, pH, and turbidity are measures using sensors and the water quality index is determined. The measured values from the sensors will be processed using amicrocontroller, and alert message will be sent to the user viaan android application developed using MIT app inventor in case of any abnormalities

A Development and Implementation of Water QualityAssessment Monitoring (WQAM) System using the Internet ofThings (IoT) in Water Environment Muhammad Farhan Johan, S. Abdullah, A. Zanal Saurabh S. Soman, HamidrezaZareipour , Om Malik JEVA , 23November 2021

- This paper presents the development and implementation

of Water Quality Assessment and Monitoring (WQAM)

system.

- The system development used Wi-Fi enabled microcontroller to connect with the IoT environment and store the data in the IoT cloud server. The microcontroller used is Arduino UNO that interacts with three types of sensor probes which are pH, turbidity and temperature probe. All the data measurements is transferred using a Wi-Fi module which is ESP8266. The IoT cloud used to utilize the data frame is Thing Speak.This system was implemented on Bandar Pereda Lake and Deraa River in Pulao Pinang with two systems implemented at each location. The sensors were placed on the water surface for more accurate measurements. This system continuously measures the readings of pH, turbidity ,temperature on the lake/river for every 1 hour. Twenty readings were taken for every 1 hour within the first 20 minutes with 1 minute interval and the readings were stored in the IoT cloud server.

IoT-based System for Real-time Water Pollution Monitoring ofRivers

Mohammad Ariful Islam Khan; Mohammad Akidul Hoque; Sabbir Ahmed IEEE September 2021

- The research proposes a system to remotely monitor the water quality of a river so that the authorities can gather better insights about the condition of that particular river and predict the critical future phenomena.
- Consequently, they will be able to take auspicious steps in order to protect the rivers and save the environment. The proposed framework can observe the real-time value of pH, conductivity, turbidity, temperature and flow of the water by utilizing various sensors. Furthermore, through our device, effective predictions about imminent floods can be made. Thus, authorities can commence early warning for floods and ensure prompt evacuation. Thus, our technique can significantly minimize the casualties caused by this disaster.
- In this context, real-time feeds are obtained through Internet of Things (IoT). For wireless data transmission Message Queuing Telemetry Transport (MQTT) is used.

Design and Implementation of Real Time

Approach for TheMonitoring of Water Quality

Parameters Siti Aishah Binti Makhtar; Norhafizah Binti Burham; AneesBt Abdul Aziz IEEE **- June 2022**

- Access to safe drinking water is essential to nurturing human life on earth. Polluted air and unsanitary water can cause health problems.
- Unhygienic water can cause stomach and healthrelated problems. A specific range of water quality parameters, mainly temperature, pH, total dissolved solids (TDS) and turbidity, can degrade the growth of this bacteria. This presented paperwork is to develop a smart water quality monitoring system using four sensors and an IoT platform to help determine water quality. It is to analyse the parameters of water samples such as tap water, co way water, river water, pond water, and lake water whether these water samples are in the threshold range for drinking or not.

- The device is initially used to measure pH, turbidity, total dissolved solids (TDS) and temperature, and then sent the information to the microcontroller Arduino Uno. IoT Based

Real-time River Water Quality Monitoring System

Mohammad Salah UddinChowdury, Talha BinEmran,

Science Direct – 2018

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

2.2 REFERENCE

- can be done by using remote monitoring and Internet of Things (IoT) technology
- Central Pollution Control Board (2013) Status of water quality in India 2011.Central Pollution Control Board, New DelhiCentral Water Commission Ministry of Water Resources India (2014) Report on Krishna River Basin Version 2.0
- Geetha S, Gouthami S (2016) Internet of things enabled real time water quality monitoring system. Smart Water 2:1. https://doi.org/10.1186/s40713-017-0005-y
- Herojeet R, Rishi MS, Lata R, Sharma R (2016) Application of environmetrics statistical models and water quality index for groundwater quality characterization of alluvial aquifer of Nalagarh Valley, Himachal Pradesh, India. Sustain Water Resource Manage 2:39–53. https://doi.org/10.1007/s40899-015-0039-y
- Verma S, Prachi (2012) Wireless Sensor Network application for water quality monitoring in India. Comput Commun Syst (NCCCS), 2012 Natl Conf 1–5. https://doi.org/10.1109/ncccs.2012.6412990]VishnuRadhan R, Zainudin Z, Sreekanth GB et al (2017) Temporal water quality response in an urban river: a case study in peninsular Malaysia. Apply Water Sci 7:923–933. https://doi.org/10.1007/s13201-015-0303-1
- K. S. Adu-Manu, C. Tapparello, W. Heinzelman, F. A. Katsriku, and J.-D. Abdulai, "Water quality monitoring using wireless sensor networks: Current trends and future research directions," ACM Transactions on Sensor Networks (TOSN),vol. 13, p. 4, 2017.
- B. Chen, Y. Song, T. Jiang, Z. Chen, B. Huang, and B. Xu, "Real-time estimation of population exposure to PM2.5 using mobile- and station-based big data," Int J Environ Res Public Health, vol. 15, Mar 23 2018.
- B. Paul, "Sensor based water quality monitoring system," BRAC University, 2018.

- K. Andersson and M. S. Hossain, "Smart Risk Assessment Systems using Belief-rule-based DSS and WSN Technologies", in 2014 4thInternational Conference on Wireless Communications, Vehicular Technology, Information Theory and Aerospace and Electronic Systems, VITAE 2014 : Co-located with Global Wireless Summit, Aalborg, Denmark 11-14 May 2014, 2014.
- S. Thombre, R. U. Islam, K. Andersson, and M. S. Hossain, "IP based Wireless Sensor Networks : performance Analysis using Simulations and Experiments", Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications, vol. 7, no. 3, pp. 53–76, 2016.
- K. Andersson and M. S. Hossain,"Heterogeneous Wireless Sensor Networks for Flood Prediction Decision Support Systems", in 2015 IEEE Conference onComputer Communications Workshops (INFOCOM WKSHPS) : 6thIEEE INFOCOM International Workshop on Mobility Management in the Networks of the Future World, 2015, pp. 133–137.
- S. Thombre, R. U. Islam, K.Andersson, and M. S. Hossain, "Performance Analysis of an IP based Protocol Stack for WSNs", in Proceedings of the 2016 IEEE Conference on Computer Communications Workshops (INFOCOM WKSHPS), 2016, pp. 691–696.
- M. Z. Abedin, A. S. Chowdhury, M. S. Hossain, K. Andersson, and R. Karim, "An Interoperable IP based WSN for Smart Irrigation Systems", presented at the 14th Annual IEEE Consumer Communications & Networking Conference, Las Vegas, 8-11 January 2017, 2017.
- M. Z. Abedin, S. Paul, S. Akhter, K. N. E. A. Siddiquee, M.S. Hossain, and K. Andersson, "Selection of Energy Efficient Routing Protocol for IrrigationEnabled by Wireless Sensor Networks", in Proceedings of 2017 IEEE 42ndConference on Local Computer Networks Workshops, 2017, pp. 75–81.
- R. Ul Islam, K.Andersson, and M. S. Hossain, "Heterogeneous Wireless Sensor Networks Using CoAP and SMS to Predict Natural Disasters", in Proceedings of the 2017 IEEE Conference on Computer Communications Workshops (INFOCOM WKSHPS) : The 8thIEEE INFOCOM International Workshop on Mobility Management in the Networks of the Future World (MobiWorld'17), 2017, pp. 30–35.
- K. N. E. A. Siddiquee, F. F. Khan, K. Andersson, and M. S. Hossain,"Optimal Dynamic Routing Protocols for Agro-Sensor Communication in MANETs", in Proceedings of the 14th Annual IEEE Consumer Communications & Networking Conference, Las Vegas, 8-11 January 2017.
- M. E. Alam, M. S. Kaiser, M. S. Hossain, and K. Andersson, "An IoT-Belief Rule Base Smart System to Assess Autism", in Proceedings of the 4thInternational Conference on Electrical Engineering and Information & Communication Technology (iCEEiCT 2018), 2018, pp. 671–675.

- P. W. Rundel, E. A. Graham, M. F. Allen, J. C. Fisher, and T. C. Harmon, "Environmental sensor networks in ecological research," New Phytologist,vol. 182, pp. 589-607, 2009.
- N. Chilamkurti, S. Zeadally, A. Vasilakos, and V. Sharma, "Cross-layer support for energy efficient routingin wireless sensor networks," Journal of Sensors, vol. 2009, 2009.
- H. R. Maier and G. C. Dandy, "The use of artificial neural networks for the prediction of water quality parameters," Water resources Research,vol. 32, pp. 1013-1022, 1996.
- N. Vijayakumar and R. Ramya, "The real time monitoring of water quality in IoT environment," in 2015 International Conference on Innovations inInformation, Embedded and Communication Systems (ICIIECS), 2015, pp. 1-5.
- T. White, Hadoop: The definitive guide: " O'Reilly Media, Inc.", 2012.
- K. Jain, J. Mao, and K. Mohiuddin, "Artificial neural networks: A tutorial," Computer, pp. 31-44, 1996.
- H. R. Maier and G. C. Dandy, "The use of artificial neural networks for the prediction of water quality parameters," Water resources Research,vol. 32, pp. 1013-1022, 1996.
- M. S. Hossain, S. Rahaman,R. Mustafa, and K. Andersson, "A belief rule-based expert system to assess suspicion of acute coronary syndrome (ACS) under uncertainty", Soft Computing - A Fusion of Foundations, Methodologies and Applications, vol. 22, no. 22, pp. 7571–7586, 2018.
- T. Mahmud, K. N. Rahman, and M. S. Hossain, "Evaluation of Job Offers Using Evidential Reasoning", Global Journal of Computer Science and Technology, Vol. 13, No. 6, 2013, pp. 41-50.
- M. S. Hossain, K. Andersson, and S. Naznin, "A Belief Rule Based Expert System to Diagnose Measles under Uncertainty", in Proceedings of the 2015 International Conference on Health Informatics and Medical Systems (HIMS'15), 2015, pp. 17–23.
- M.S. Hossain, PO., Zander, S. Kamal, and L. Chowdhury, "Belief Rule Based Expert Systems to Evaluate E-Government",Expert Systems,The Journal of Knowledge Engineering, Vol. 32, No.5, 2015, Jhon Wiley & Sons Ltd.
- M. S. Hossain, F. Ahmed, F.Tuj-Johora, and K. Andersson, "A Belief Rule Based Expert System to AssessTuberculosis under Uncertainty", Journal of medical systems,vol. 41, no. 3, 2017.
- M. S. Hossain, S. Rahaman, A.-L. Kor, K. Andersson, and C. Pattison, "A Belief Rule Based Expert System for Datacenter PUE Prediction under Uncertainty", IEEE Transactions on Sustainable Computing, vol. 2, no. 2, pp. 140–153, 2017 R. Ul Islam, M. S. Hossain, andK. Andersson, "A Novel Anomaly Detection Algorithm foR Data Under Uncertainty", Soft Computing - A Fusionof Foundations, Methodologies and Applications 22(5):1623–1639, 2018
- M. Z. Abedin, N. A. Chandra, D. Prashengit, D. Kaushik, and M. S. Hossain, "License Plate Recognition System Based On Contour Properties and Deep Learning Model"in Proceedings of the IEEE Region 10 Humanitarian Technology Conference, 2017, pp. 590-593

2.3Problem Statement Definition

River water quality can be monitored by the web application.

Can be able to know if there are any dust particles present in the water.

The PH level of the water can be monitored.

Water temperature can be monitored.

Alerting the authorities if the water quality is not good so that they can go and announce the localities not to drink that water.

3. IDEATION AND PROPOSED SOLUTION

3.1 Empathy Map Canvas

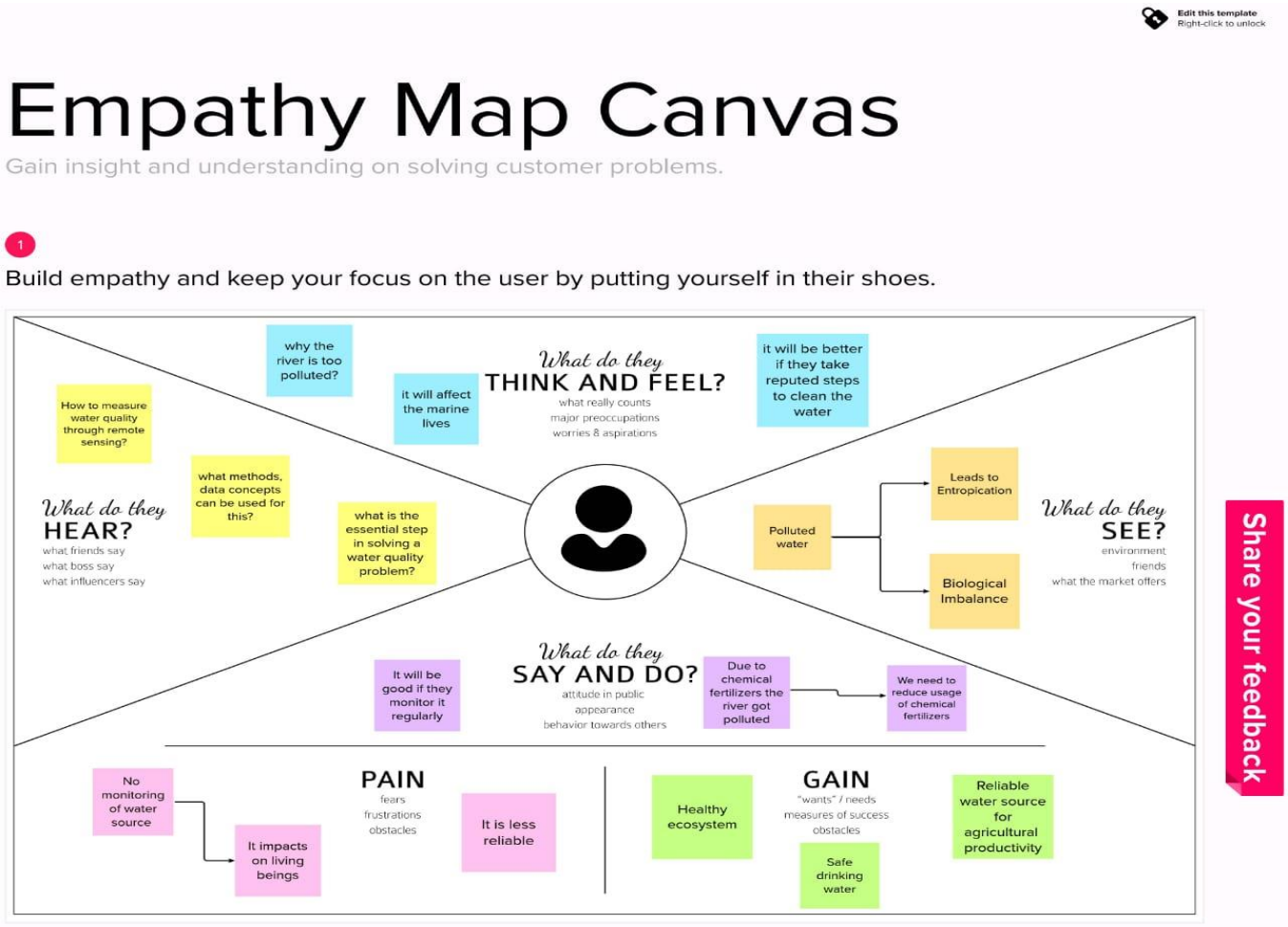


Fig.3.1 Empathy Map Canvas

3.2 Ideation and Brainstroming

Ideation phase: The main aim is to develop a system for continuous monitoring of river water quality at remote places using wireless sensor networks with low-power consumption, low-cost and high detection accuracy. pH , conductivity, turbidity level etc are the limits that are analysed to improve the water quality.

Following are the aims of idea implementation

- ✓ To measure water parameters such as pH, dissolved oxygen, turbidity,conductivity, etc. using available sensors at a remote place.
- ✓ To assemble data from various sensor nodes and send it tothebasestation by the wireless channel.
- ✓ To simulate and evaluate quality parameters for quality control.
- ✓ To send SMS to an authorized person routinely when water qualitydetected does not match the preset standards, so that, necessaryactionscan be taken.

Control surface:

An Arduino mega is utilized as a core person. The Arduino victimizedhere is mega 2560 because multiple analog sign sensors proberequisiteto be conterminous with the Arduino inhabit. It has a set of registersthat use as a solon use RAM.

Specific intend to know registers for on-chipcomponent resources are also mapped into the assemblage grapheme. The addressability of store varies depending on instrumentationseriesand all PIC devices someone several banking mechanisms toutiliseaddressing to additional faculty. Subsequent series of devices have move instructions which cancovert move had to be achieved via the register.

Thus the mechanismfunctionswith the exploit of coding intrinsically in the Arduino UNOR3 skate.

pH sensor:

- The pH of thing is a useful constant to display because graduateandlowpH levels can hump large effects on the author. The pHof a statement can grasp from 1 to 14.
- A pH sensor is an instrumentation that measuresthe hydrogen-ion density in a bleach, indicating its tartness alkalinity.
- Itsconstitute varies from 0 to 14 pH. Uttermost pH values also process the solubility of elements and compounds makingthemcyanogenetic. Mathematically pH is referred as, pH = -log [H+].

Turbidity sensor:

- Turbidity train sensor is victimised to measure the clarity of element ormuddiness utter in the water.
- The muddiness of the open cut food is ordinarily between 255NTU. Irrigate is visibly at levels above 80 NTU. The standards for intemperance liquid is 130 NTU to 250 NTU. The turbidity deviceconsists of soft sender and acquirer, the transmitter needs totransmit unsubtle bright, it is said to be turbid.
- The consequence of turbidity is a reduction in water clarity aesthetically unpleasant, decreases the rate of photosynthesis, increases water temperature.

Temperature sensor:

- Here DS18B20 is old as the temperature device. Usually, its present use to perceive the temperature of the life, if we site the devicewrongthe conductor electrode and placed into the H2O, it can discover thetemperature of H2O also.
- The normal temperature of the people is (25 -30)° C. LCD display: LCD (Liquid Crystal Display) impede is a flat brace electronicexhibit power and finds in a countywide orbit of applications.
- A16x2LCDdemo is the really fundamental power and is rattling commonlyvictimised in varied devices and circuits.
- These modules are desirable over heptad segments and otherwisemulti-segment LEDs.

Wi-Fi module:

- Wi-Fi or Wi-Fi is a subject for wireless localized area schemewithdevices. Devices that can use Wi-Fi study permit private computers, video-game consoles, smartphones, digital cameras, paper computers,digital frequency players and ultramodern printers.
- Wi-Fi matched devices can insert to the Cyberspace via a LANweband wireless make a bushel. Much a reach quantity (or point) hasacapableness of around 20 meters (66 feet) indoors and a greater compass outdoors.
- Wi-Fi subject may be utilised to render the Internet reach todevicesthat are within the capability of a wireless meshwork that is connectedto the Internet.

Software design:

The proposed water quality monitoring system based on WSNcanbedivided into three parts:

• IoT platform

• Neural network models in Big Data Analytics and water qualitymanagement

• Real-time monitoring of water quality by using IoT integratedBigDataAnalytics

IoT Platform :

- The quality parameters are labeled datasets including desiredoutputsof specific combination of inputs.
- The neural network will produce output to classify water qualityasdangerous, be careful, and good. The classification layer will runontop of Hadoop cluster.
- The advantages of using neural network based analytics arelikeArtificial Neural Networks (ANNs) are good in learning andmodelingnon-linear relationships, and high volatile data.
- Though neural networks are prone to over fitting, the neural network model usedinwater quality monitoring system is not complex enough to causeoverfitting problem.
- Also, there are many countermeasures to avoidoverfitting.Also, computation overload is not going to delay the responseofsystem as there are only a few water quality parameters.

Neural network models in Big Data Analytics andwater quality management:

- The use of artificial neural networks for the prediction of water qualityparameters has already beeninvestigated long before . Multi-layer neural network model is depicted below having five inputs In1, In2, In3, In 4,In 5 in input layer, a hidden layer with four neurons andthreeneurons in output layer.
- There are two bias input neuron connected to hidden layer neuronsand output layer neurons.
- In the neural network model 5 inputs can be pH value, temperature, turbidity, ORP, and conductivity and 3 outputs will be dangerous, becareful, and good.
- Before training the neural network model few other parametersneedto be set; as for example:
- Learning rate = 0.01, Learning algorithm=BackPropagation, Bias input =1,Connection weights = randomly assigned, Activation function = sigmoid function.

- The output of sigmoid function neuron withinputs: Xj, weights: Wj andbias b is :

$F(X) = 1 / (1 + \exp(- \Sigma jwjxj - b))$

Real-time monitoring of water quality by using IoTintegrated Big Data Analytics:

- IoT devices use various types of sensors to collect data about turbidity,ORP, temperature, pH,conductivity, etc. of river water continuously.
- Also, IoTthe array of collected data wirelessly to the remoteDataAggregator Server in the cloud. Moreover, the volume of semi structured data increases withtimeinsuch a velocity that only the Big Data Analytics applications canefficiently store and analyze the data constantly . The systemshouldbereliable and scalable.
- So, data management layer will be deployed and operational ontheApache Hadoop cluster.Hadoop helps distributed storingandprocessing of big data across cluster of computers.Also,suchoperational environment is horizontally scalable i.e. nodesorcomputers can be added to a cluster later while volume andvelocityofdata streaming will be increasing.
- Hadoop cluster is fault tolerant as jobs are redirected automaticallytothe running nodes when nodes are failed. The data in Hadoop is highly available as multiple copies of dataarestored in data nodes managed by name node, standby namenode, journal nodes and fail over controller.
- IoT applications need high speed of read/write of data andhighlyavailable data in the database. So,the system will use ApacheHBaseNoSQL database to store big data as HBase runs on top of Hadoop. Hence, the data is distributed across Hadoop distributed filesystem(HDFS) .
- Besides, HBase is capable of executing real-time queries aswell as batch processing. High-availability of data is providedbytheHBase as it is stored in HDFS. Hadoop clusters are spanningover manyservers which are managed by Apache ZooKeeper.Such centralizedmanagement of the cluster is required to provide cross-nodesynchronization services and configuration management.
- Applicationscan create znode (a file which persists the state of the cluster inthememory) in zookeeper. Nodes will register to znode to synchronize task executions acrossthecluster by sharing and updating status changes in nodes throughtheuse of zookeeper znode.

Brainstroming - Prioritization of ideas

Zone-1:

- Awareness among farmers to reduce fertilizers
- Decreasing Nutrients level(Nitrate, phosphate)
- Avoid sewage disposal in the lake
- Altering through SMS
- pH level monitoring
- Analyze dust particles in water

Zone-2:

- Encourage to use organic manure

Zone-3:

- Creating alert warning system

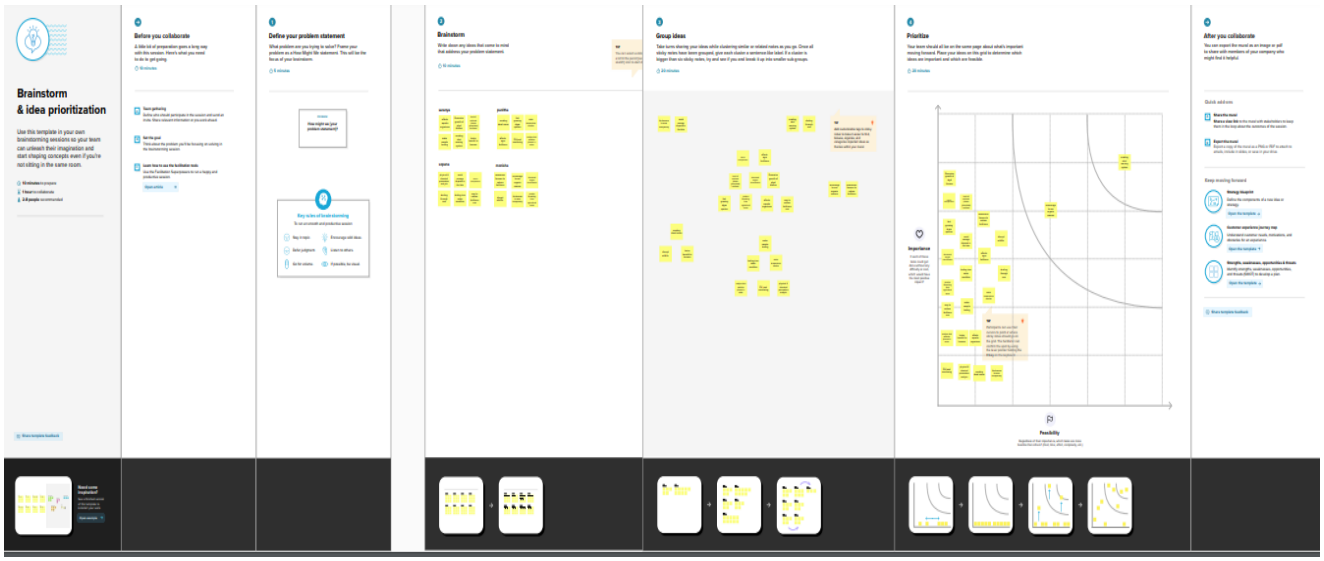


Fig 3.2 Ideation & Brainstroming

3.3 PROPOSED SOLUTION

Table.3.3.1 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 , 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 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. Aeronsystems.com
6.	Scalability of the Solution	Measuring of real time values and continuous monitoring helps in maintaining the quality of water.

Table3.3.2 Proposed Solution

Define CS, fit into CC			Explore AS, differentiate
1. CUSTOMER SEGMENT(S) CS Who is your customer? i.e. working parents of 0-5 y.o. kids People living in rural areas near to the river ,who uses river water	6. CUSTOMER CONSTRAINTS CC What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices. Water quality monitoring system is used for identify the water pollution on specific area. People may find it hard to recover if any fault occurs,this system prevent people from water pollution.	5. AVAILABLE SOLUTIONS AS Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking Individual notification to each people could be sent,it is not possible . this system will still notify the corporation and they can further notify the people to aware.	

Focus on J&P, tap into BE, understand RC			Focus on J&P, tap into BE, understand RC
2. JOBS-TO-BE-DONE / PROBLEMS J&P Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides. The river water quality monitoring system that checks periodically ,the dust particles,temperature and PH level and gave notifies for the public when the water quality varies	9. PROBLEM ROOT CAUSE RC What is the real reason that this problem exists? What is the back story behind the need to do this job? i.e. customers have to do it because of the change in regulations. We know that the sensor are expensive and the system needs more than one sensors to work,these sensors are used periodically to check the quality of water and if any problem, need to be replace frequently.	7. BEHAVIOUR BE What does your customer do to address the problem and get the job done? i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace) The customer could use the user guide provided to overcame the problem or else they can report and contact the corporation. They will take care of the problem.	

3.4 SOLUTION FIT

3. TRIGGERS TR What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news. if certain area people start using this quality monitoring system and so they are staying healthy without any disease and harmful algal blooms. thus will trigger the other affected area people to use this same system.	10. YOUR SOLUTION SL If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour. Altering the authorities if the water quality is not good . so that they can go and announce to the localities not to drink that water or live any living things.	8.CHANNELS of BEHAVIOUR CH 8.1 ONLINE What kind of actions do customers take online? Extract online channels from #7 if it is in online mode , they can use mobile or any other sources to send the message or contact authorities via helpline number. 8.2 OFFLINE What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development. if it is in offline mode , the customers can directly reach the corporation office and report the problem.
4. EMOTIONS: BEFORE / AFTER EM How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure > confident, in control - use it in your communication strategy & design. the customer feels hard to recover their problems ,but now we will guide them with a user guide and they will find solutions to their problems.		

Fig.3.4 Solution Fit

4. REQUIREMENT ANALYSIS

4.1 Functional Requirement

Table:4.1 Functional Requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Arduino(control system)	Sensors are interfaced to Arduino and it collects measurements data periodically from sensors.
FR-2	WSN Sensor	Multiple sensor nodes installed for the detection of pH, temperature, dust particles, turbidity.
FR-3	Software Design Requirements	WSN requires IoT platform which requires Neural Network Model to classify water quality as Good Or Bad. IoT integrated big data analytics to store data in cloud and analyze it constantly.
FR-4	LCD/PC/Mobile display	Displays the resulting sensed pH, temperature, turbidity. If ,acquired value > Threshold value, then comment=BAD. If, acquired value < Threshold value, then comment=GOOD.

4.2 Non-Functional Requirement

Table:4.2 Non-Functional Requirement

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	It is important to monitor water quality to ensure that, it is safe for humans to drink it as well as for wild life and marine life and to understand environmental impacts and to not harm sea life.
NFR-2	**Security**	The IoT networks are incredibly safe and communication speed is also high. The technology comfortably resolves all the issues.
NFR-3	**Reliability**	The water quality and monitoring system is reliable and it's output can be assured. Since standardized hardware components and software designs are used.
NFR-4	**Performance**	Real-time quality of water is executed and alertring the authorities if water quality is not good.

5. PROJECT DESIGN

5.1 Data Flow Diagrams

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

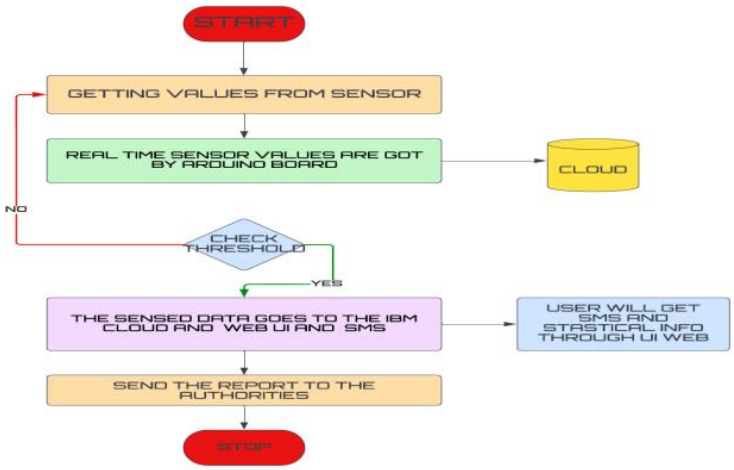


Fig 5.1 Data flow Diagram

5.2 Solution & Technical Architecture

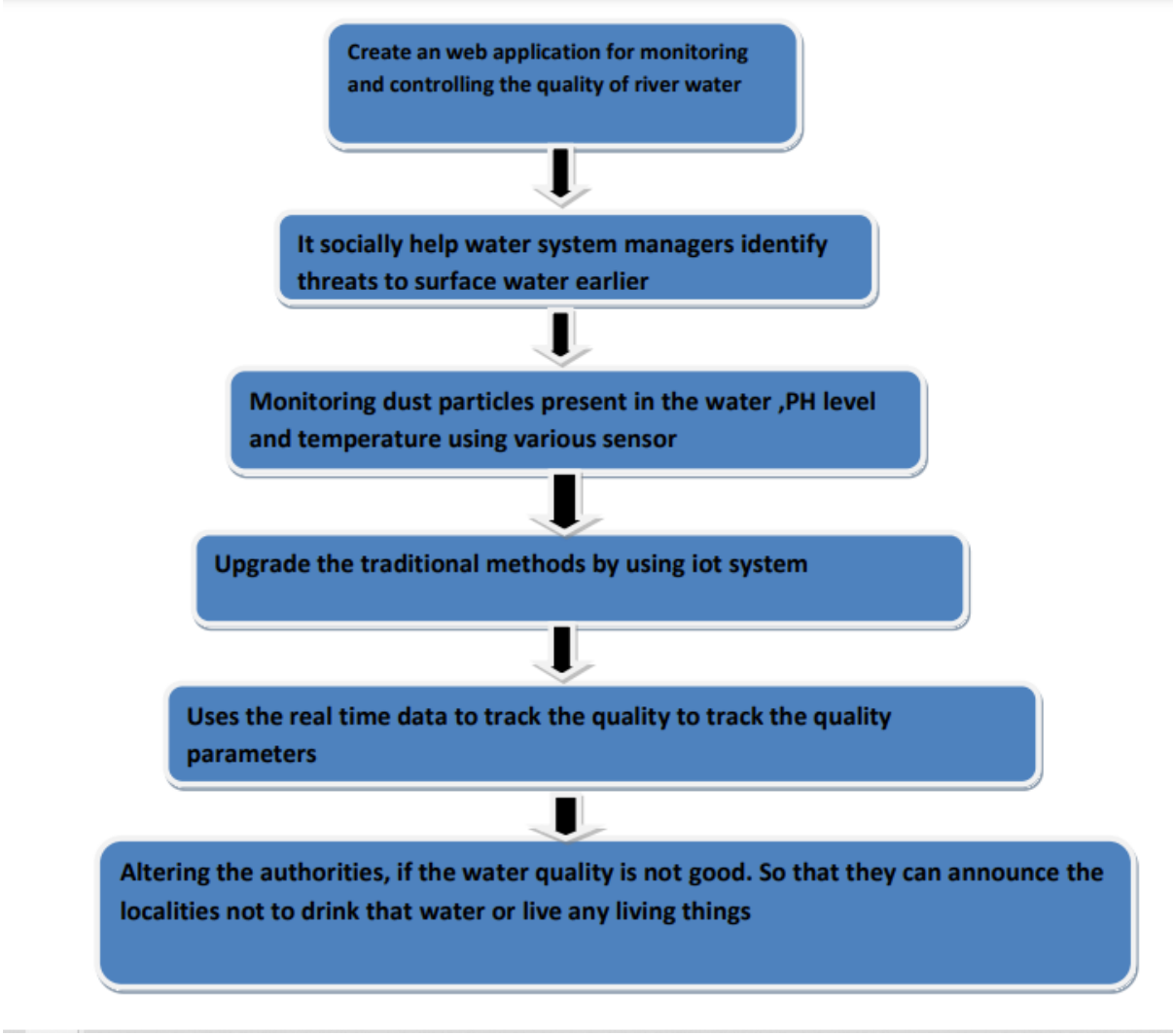


Fig 5.2 Solution & Technical Architecture

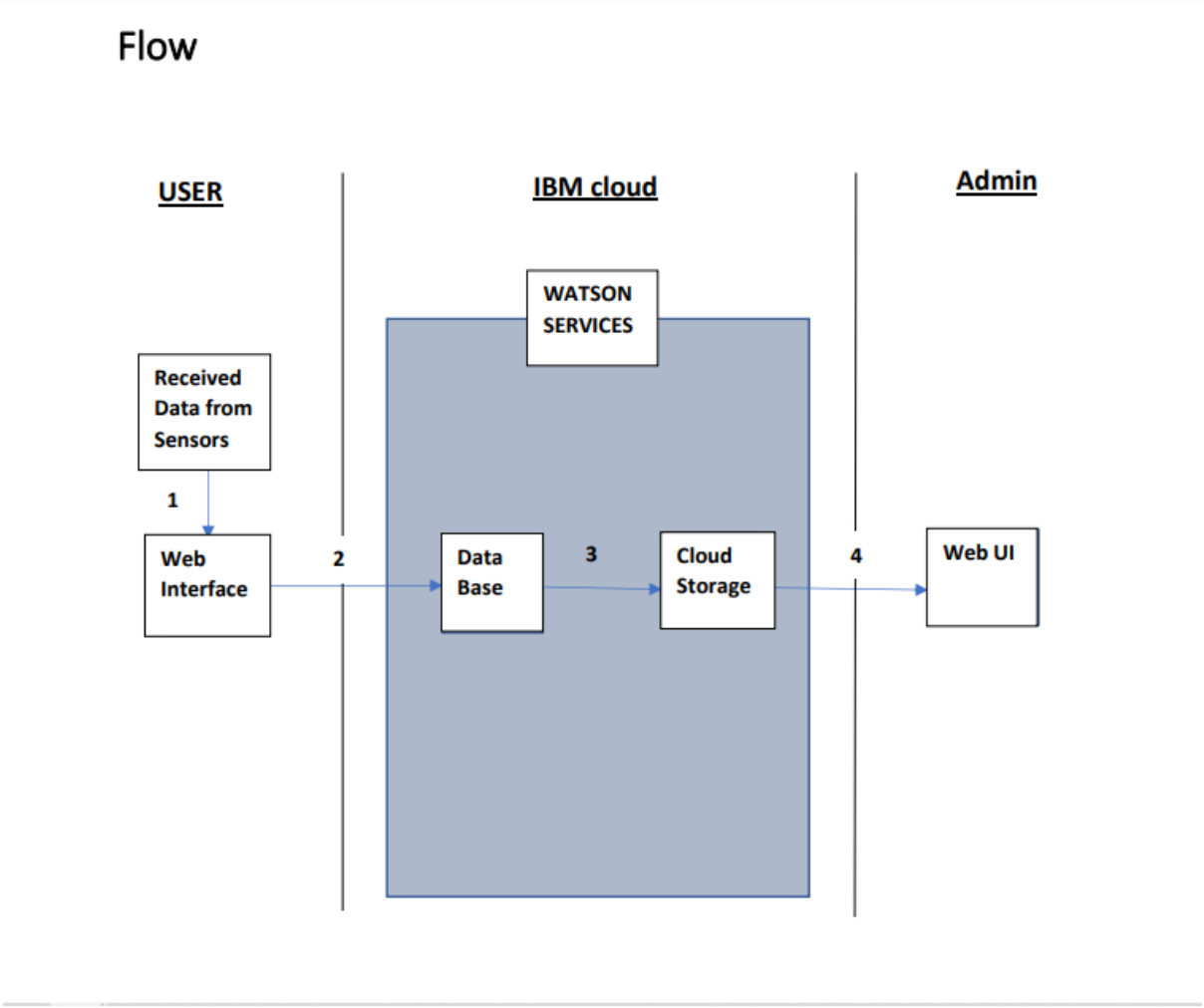


Fig 5.2.1 Solution & Technical Architecture Flow

1) Feed the data received from the Sensor unit which are placed in the river sides.

2) The collected data will be displayed in the Web page to the user. Received Data from Sensors Web Interface Data Base Cloud Storage Web UI WATSON SERVICES USER IBM cloud Admin 1 2 3 4

3) Then the collected data is sent to the data base, where the collected data and the predefined data are checked and monitored. If any data exceed the predefined date then the control signal will send to the Admin.

4)The collected data will be stored in the IBM cloud storage .

5)Later the data will be controlled by the admin via Web UI.

Table 5.2.2 Component & Tecnology

Components & Technologies:

S.No	Component	Description	Technology
1.	Received Data from Sensors	The data collected form the sensor units placed in the river sides.	ESP32 wifi module
2.	Web Interface	The collected data were displayed visually.	HTML, CSS, JavaScript
3.	Database	Datatype	MySQL
4.	Cloud Database	Database Service on Cloud	IBM cloud
5.	Data Storage	File storage requirements	IBM Block Storage

Characteristics:

Table 5.2.3 Characterisitcs

S.No	Characteristics	Description	Technology
1.	PH level Monitoring	The PH level of river water can be monitored via placing sensors in rivers.	PH-sensor
2.	Temperature Monitoring	The temperature of river water can be monitored	Temperature sensor
3.	Pollution Monitoring	The clarity and purity of river water can be Monitored.	Conductive sensor

5.3 User Stories

Table 5.3 User stories

User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering email, password, and confirming my password.	I can access my account/dashboard	High	Sprint-1
		USN-2	As a user, I will receive a confirmation email once I have registered for the application	I can receive e confirmation email & click confirm	High	Sprint-2
		USN-3	As a user, I can register for the application through Google	I can register & access the dashboard with Google	High	Sprint-1
		USN-4	As a user, I can register for the application through Gmail	I can register through the mail.	Medium	Sprint-2
	Login	USN-5	As a user, I can log into the application by entering email, password & captcha	I can receive login credentials.	High	Sprint-1
	Interface	USN-6	As a user, the interface should be user-friendly manner	I can able to access easily.	Medium	Sprint-1
Customer (Web user)	dashboard	WUSN-1	As a web user, I can access the specific info (ph value, temp, humidity, quality).	I can able to know the quality of the water.	High	Sprint-1
Customer Care Executive (input)	View manner	CCE-1	As a customer care, I can view data in visual representation manner(graph)	I can easily understand by visuals.	High	Sprint-1
	Taste	CCE-2	As a customer care , I can able to view the quality(salty) of the water	I can easily know whether it is salty or not	High	Sprint-1
	Color visibility	CCE-3	As a customer care , I can able predict the water color	I can easily know the condition by color	High	Sprint-1
Administrator	Risk tolerant	ADMIN-1	An administrator who Is handling the system should update and take care of the application.	Admin should monitor the records properly.	High	Sprint-2

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Table:6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	IBM Watson IOT platform	USN-1	Creating devices and board and generating data	1	medium	Manimegalai.k Santhiya .C Charumathi.s Inpan Rumilda.M
Sprint-2	Storing Data using node-red	USN-2	Storing the data in IBM Cloudant DB through node-red functions	2	High	Manimegalai.k Santhiya .C Charumathi.s Inpan Rumilda.M
Sprint-3	Frontend in App	USN-3	Storing the data in IBM Cloudant DB through node-red functions	1	High	Manimegalai.k Santhiya .C Charumathi.s Inpan Rumilda.M
Sprint-3	Backend in App	USN-4	Designing the block of backend for the app in MIT App	2	Low	Manimegalai.k Santhiya .C Charumathi.s Inpan Rumilda.M

			inventor			
Sprint-4	User login	USN-5	As a user, I can register for the application through Gmail and login in to the app	2	Medium	Manimegalai.k Santhiya .C Charumathi.s Inpan Rumilda.M
Sprint-1	IBM Watson IOT platform	USN-1	Creating devices and board and generating data	1	medium	Manimegalai.k Santhiya .C Charumathi.s Inpan Rumilda.M
Sprint-4	Reminder(TTS)	USN-5	Getting the speech reminder to users to take their tablet	1	high	Manimegalai.k Santhiya .C Charumathi.s Inpan Rumilda.M

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	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	24 Oct 2022	05 Nov 2022	20	31 Oct 2022
Sprint-3	20	6 Days	24 Oct	12 Nov	20	07 Nov

			2022	2022		2022

Burndown Chart:

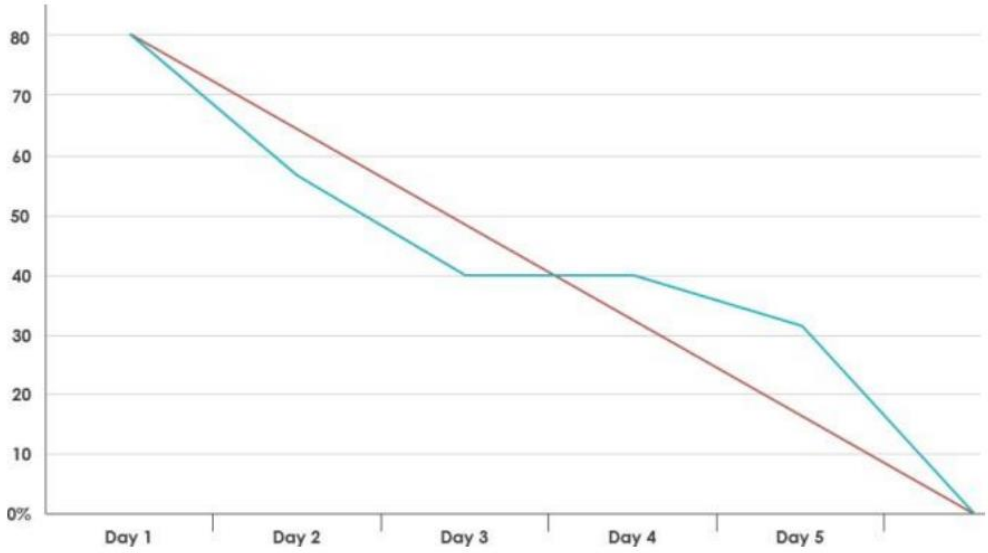


Fig 6.1.1 Sprint Planning &Estimation

6.2 Sprint Delivery Schedule

Table 6.2 Sprint delivery Schedule

S.NO	ACTIVITY TITLE	ACTIVITY DESCRIPTION	DURATION
1.	Understanding the project requirement.	The Aim is team members are assigned with tasks for each to be executed asaresponsible team lead. Also create repository in the Github, Assign members and teach how to use and open the Github and IBM career education portals .	1 WEEK
2.	Starting of project	Advisory of team lead to his team members based on regularly attending training sessions for installing and use of prerequiste .Also necessarily attending the training sessions based on python code,development of android app in mobile app invtr.com and working along NodeRed is ensured by the team lead and acknowledged by team members simultaneously	1 WEEK
3.	Attend class	Teammembers 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 WEEK

4.	Budget and scope of project	Budgetary planning process taken up on whole as a team to detect the user compatible price to the buy the product based on budgetary on IOT and component level.	1 WEEK

7. CODING & SOLUTION

7.1 FETURE 1

IBM Cloud Services:

I. Devices:

To create IBM Watson IOT platform for creating a Device

After add the device.

Send temperature,turbidity , ph values to the IBM Watson.

II. Broads:

After creating devices, we create broad chart (line chart, donut chart) for analysis the level of the temperature, turbidity and ph of the riverwater.

Python script:

III. We create a python code to detect temperature, turbidity and ph values of the river water.

IV. Send the status of temperature,turbidity , ph values to the IBM Watson using python script

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
#Provide your IBM Watson Device Credentials
```

```
organization = "55i2ca"
deviceType = "riverwater"deviceId = "12345678"
authMethod = "token"
authToken = "23452345"
def myCommandCallback(cmd):
print("Command received: %s" % cmd.data['command'])
status=cmd.data['command']
if status=="motoron":
print ("motor is on")
state="motor on"
else :
print ("motor is off")
state="motor off"
try:
deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-
method": authMethod, "auth-token": authToken}
deviceCli = ibmiotf.device.Client(deviceOptions)
#.....
except Exception as e:
print("Caught exception connecting device: %s" % str(e))
sys.exit()
print("checking status of watson iot device ... connected .....sucessfully")
deviceCli.connect()
print("dear user ... welcome to IBM-IOT ")
while True:
waterph=random.randint(1,10)
```

```
temperature=random.randint(20,50)#random temperature in water
turbidity=random.randint(10,70)#random trubidity in water
if (waterph<5):
print("ph is low in water")
waterphstatus="low ph ,bad water"
elif(waterph>5)and(waterph<7):
print("normal ph in water")
waterphstatus="good ph,good water"
else:
print("normal ph in water")waterphstatus="high ph,bad water"
if (turbidity<30):
print("turbidity is low in water")
turbiditystatus="low turbidity , dust particles is low"
elif( turbidity>30)and(waterph<7):
print("normal turbidity in water")
turbiditystatus="good turbidity, dust particles is medium "
else:
print("normal turbidity in water")
turbiditystatus="high turbidity,dust particles is more "
data = { 'temp' :
temperature,'turb':turbidity,'ph':waterph,'waterphstatus':waterphstatus,'turbiditystatus':
turbiditystatus}
#print data
def myOnPublishCallback():
print("PublishedTemperature= %sC" %temperature,"turbidity= %s %%"%
turbidity,"waterph = %s %%" % waterph )
```

success = deviceCli.publishEvent("espwatermodule", "json", data, qos=0,

on_publish=myOnPublishCallback)

if not success:

print("Not connected to IoTF")

time.sleep(5)

deviceCli.commandCallback = myCommandCallback

Disconnect the device and application from the cloud

deviceCli.disconnect()

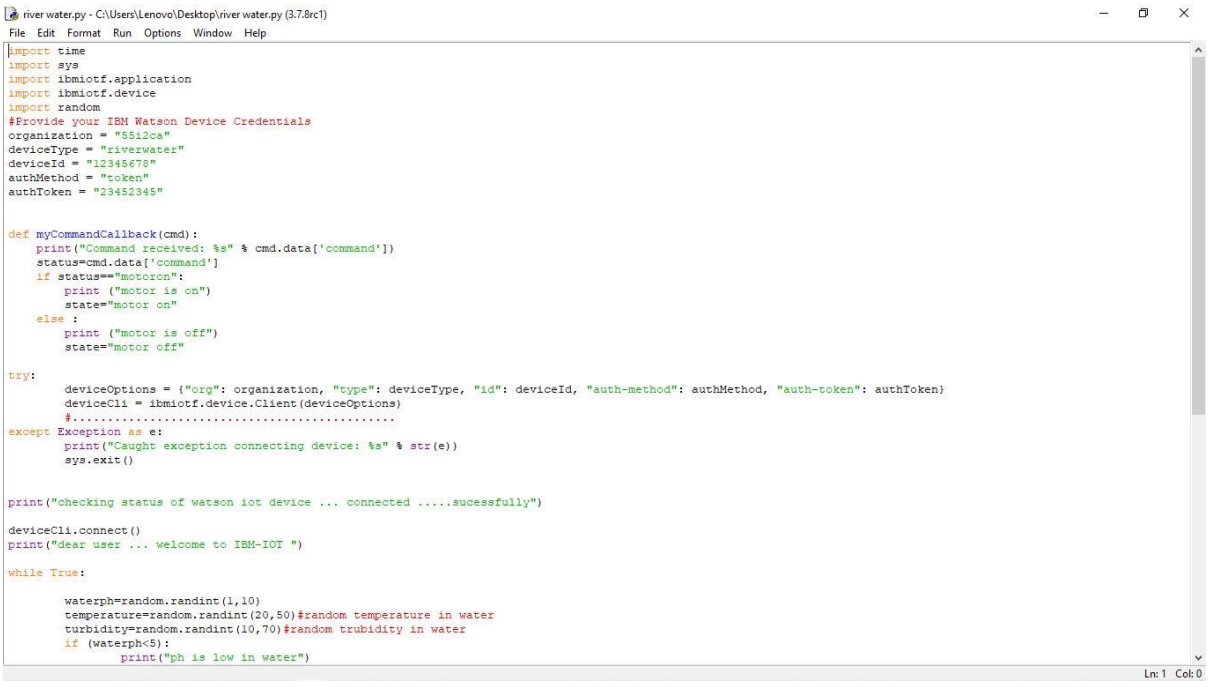


Fig 7.1.1 Coding

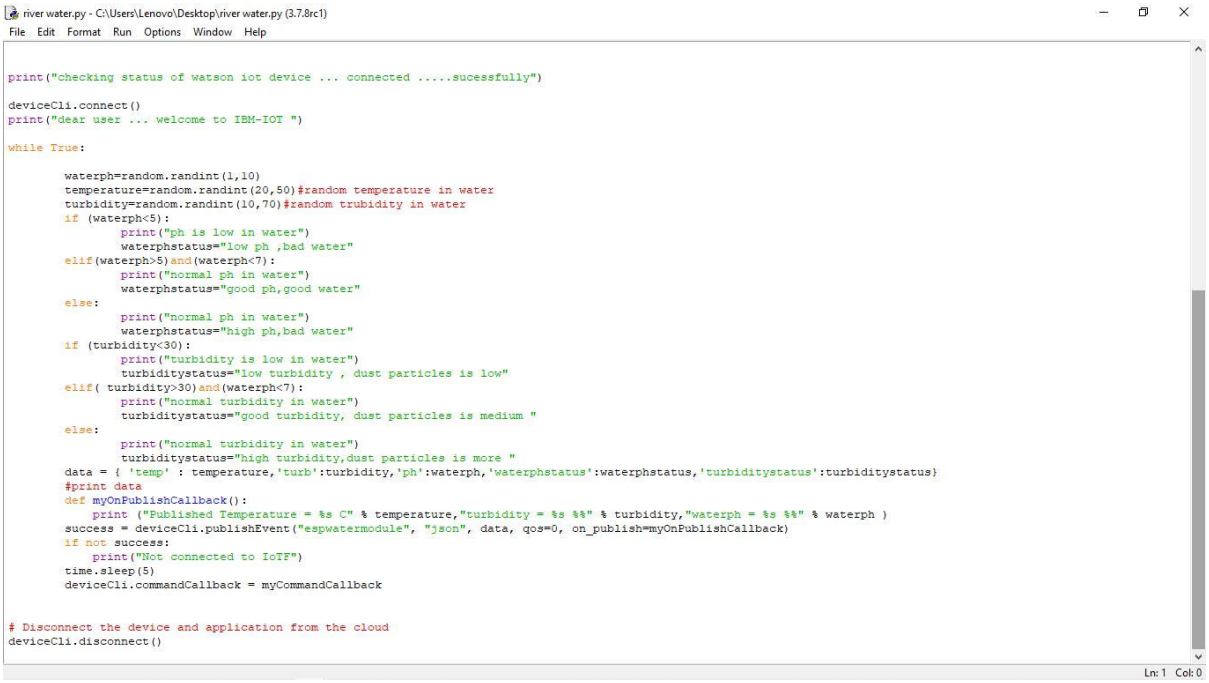


Fig:7.1.2 Coding

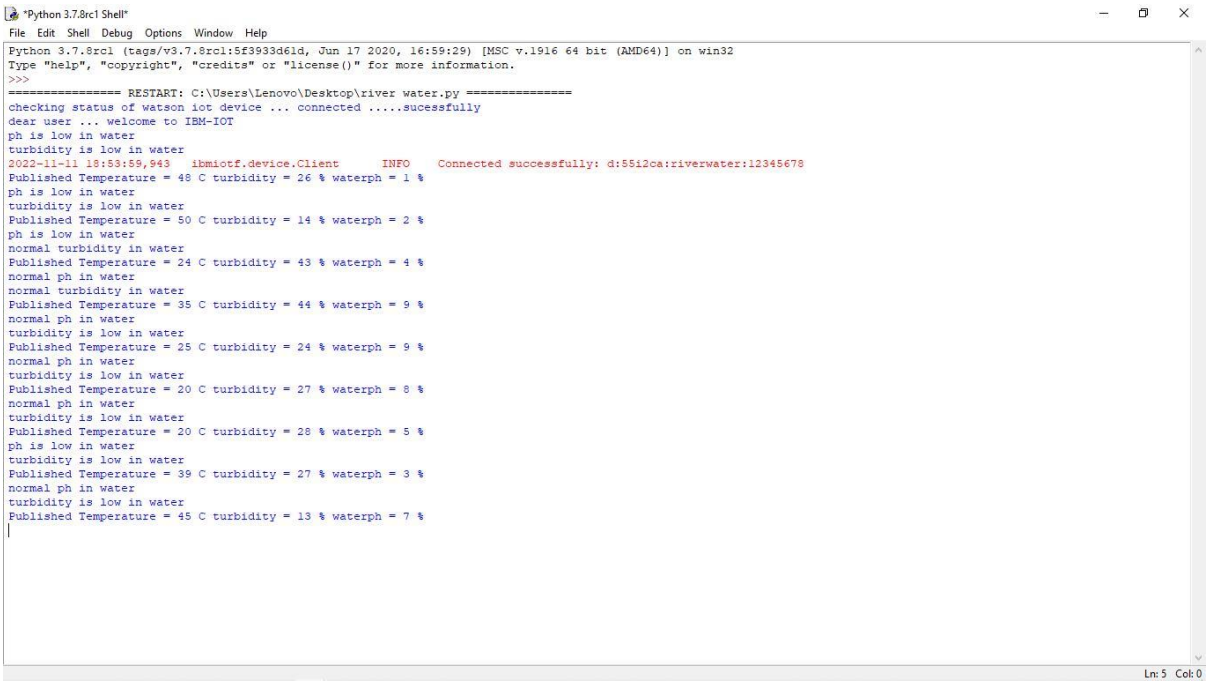


Fig :7.1.3 Coding

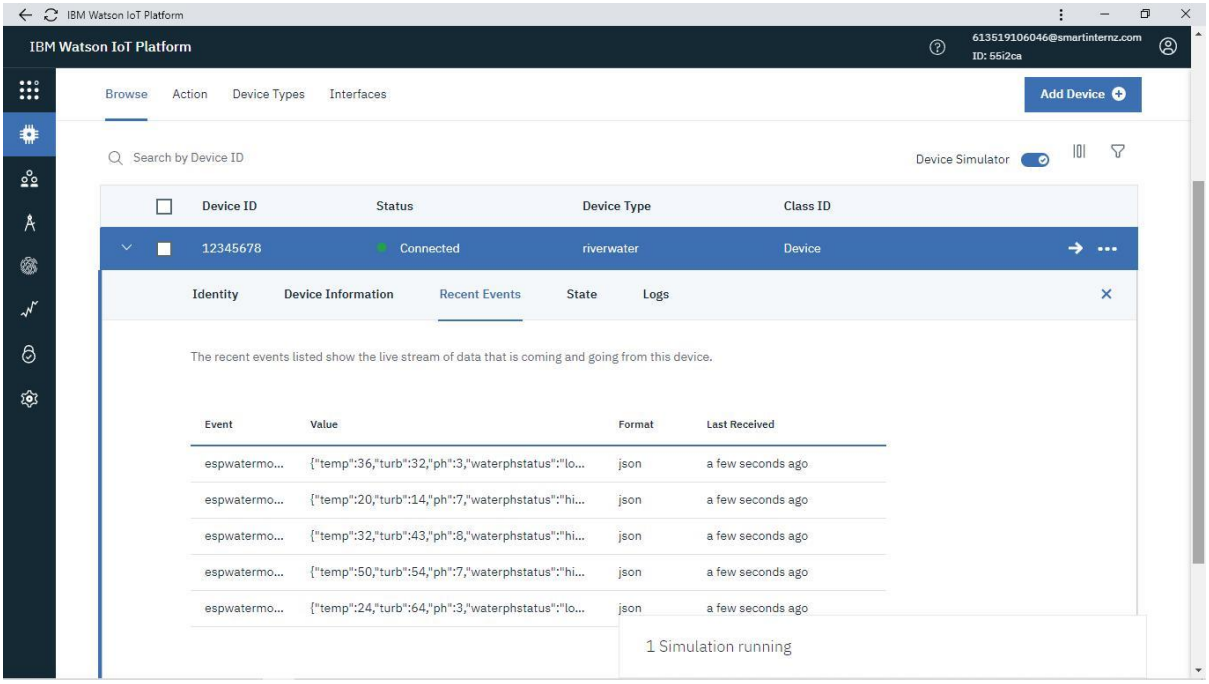


Fig:7.1.4 Coding

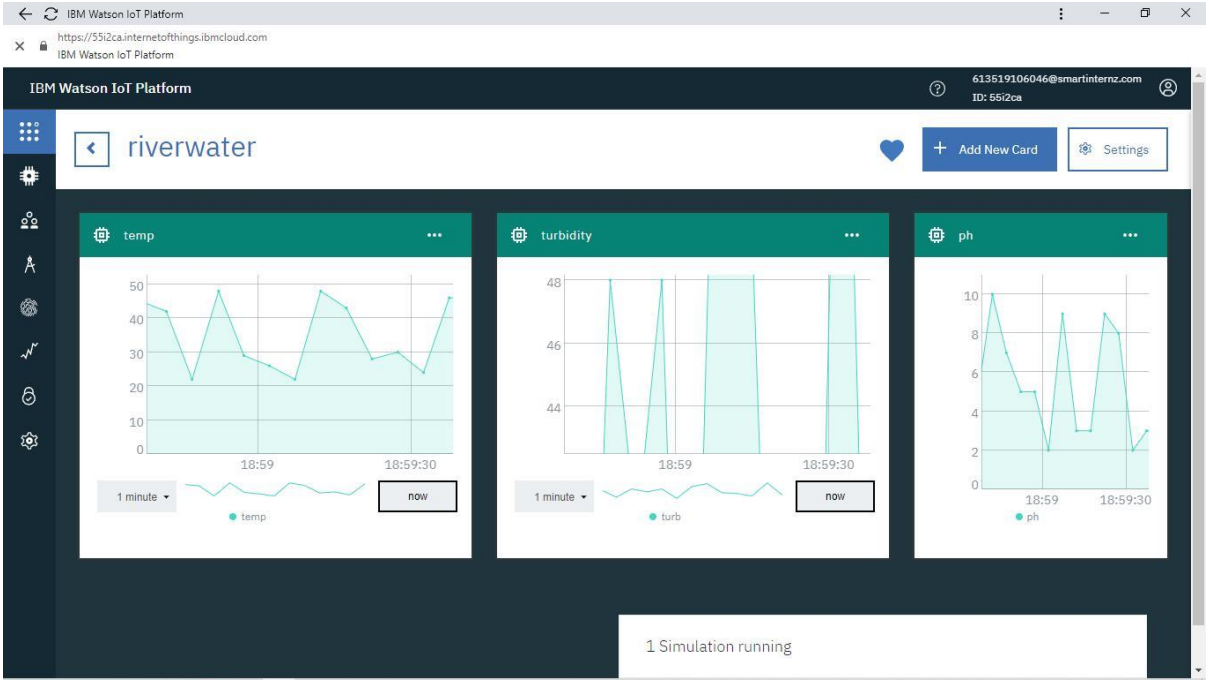


Fig:7.1.5.Coding

7.2 Feature 2

Python script:

We create a python code for motor status.

Python code (sending status of the motor):

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
#Provide your IBM Watson Device Credentials
organization = "55i2ca"
deviceType = "riverwater"
deviceId = "12345678"
authMethod = "token"
authToken = "23452345"
def myCommandCallback(cmd):
print("Command received: %s" % cmd.data['command'])
status=cmd.data['command']
if status=="motoron":
print ("motor is on")
state="motor on"
else :
print ("motor is off")
state="motor off"
try:
```

```
deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-
method": authMethod, "auth-token": authToken}
deviceCli = ibmiotf.device.Client(deviceOptions)#.....
except Exception as e:
print("Caught exception connecting device: %s" % str(e))
sys.exit()
print("checking status of watson iot device ... connected .....sucessfully")
deviceCli.connect()
print("dear user ... welcome to IBM-IOT ")
while True:
waterph=random.randint(1,10)
temperature=random.randint(20,50)#random temperature in water
turbidity=random.randint(10,70)#random trubidity in water
if (waterph<5):
print("ph is low in water")
waterphstatus="low ph ,bad water"
elif(waterph>5)and(waterph<7):
print("normal ph in water")
waterphstatus="good ph,good water"
else:
print("normal ph in water")
waterphstatus="high ph,bad water"
if (turbidity<30):
print("turbidity is low in water")
turbiditystatus="low turbidity , dust particles is low"
elif( turbidity>30)and(waterph<7):
```

```
print("normal turbidity in water")
turbiditystatus="good turbidity, dust particles is medium "
else:
print("normal turbidity in water")
turbiditystatus="high turbidity,dust particles is more "
data = { 'temp' :
temperature,'turb':turbidity,'ph':waterph,'waterphstatus':waterphstatus,'turbiditystatus':
turbiditystatus}
#print data
def myOnPublishCallback():print ("Published Temperature = %s C" % temperature,"turbidity = %s %%" %
turbidity,"waterph = %s %%" % waterph )
success = deviceCli.publishEvent("espwatermodule", "json", data, qos=0,
on_publish=myOnPublishCallback)
if not success:
print("Not connected to IoTF")
time.sleep(5)
deviceCli.commandCallback = myCommandCallback
# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

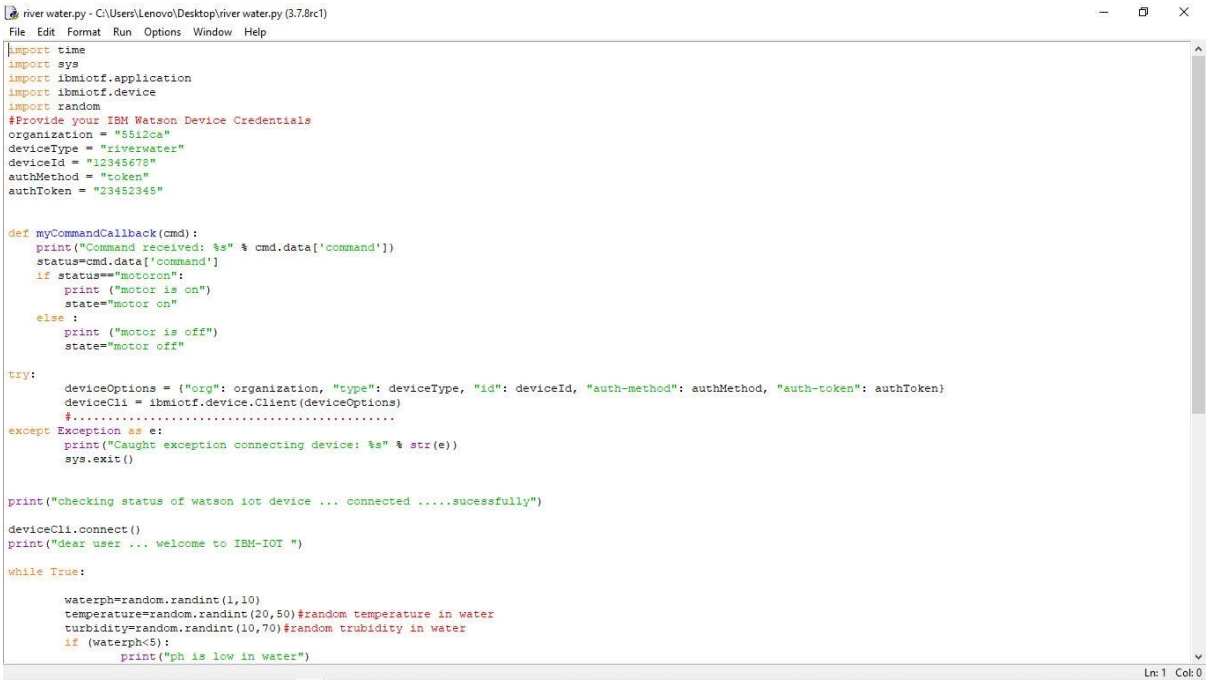


Fig:7.2.1 Coding

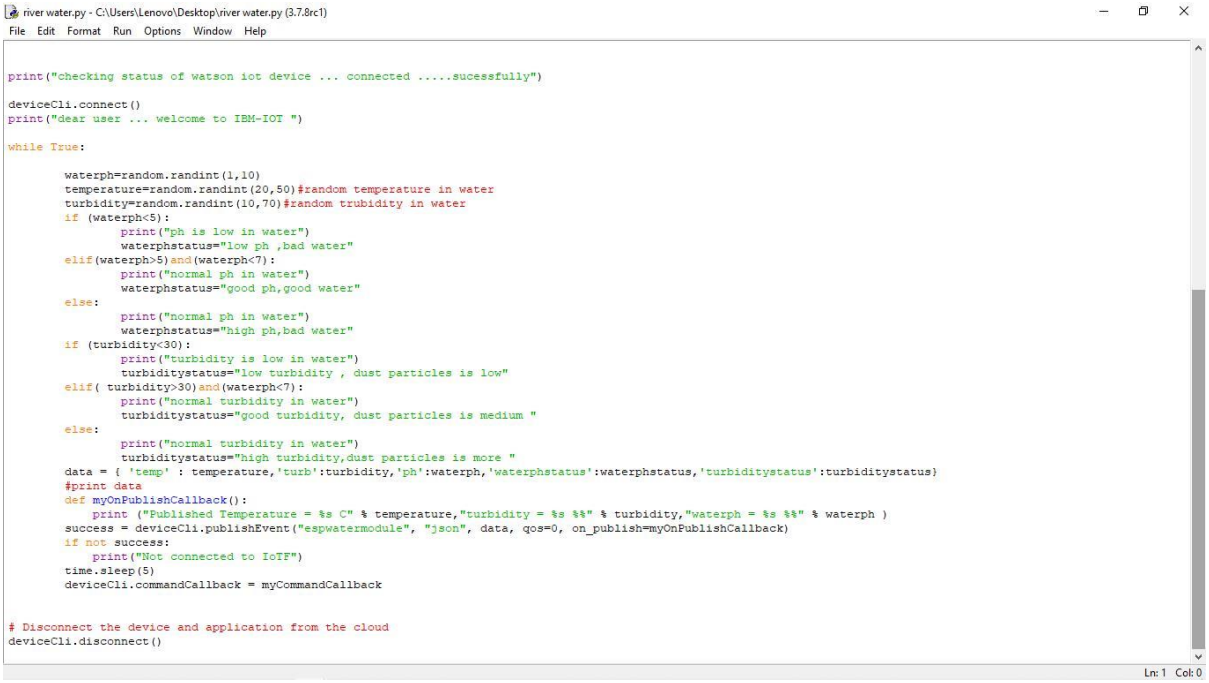


Fig:7.2.2 Coding

Fig:7.2.3 Coding

7.3 DATABASE SCHEME

Node-RED Service

The Node -RED flow to receive data from the IBM IoT platform.

And also use Cloudant DB nodes to store the received sensor data in the cloudant DB.

To create use dashboard nodes to visualize the data in graphical format.

Create an HTTP API for communicating with Mobile applications.

Building Mobile App

will build a basic mobile application to show the sensor data.

Design UI to display the Water Turbidity, and pH values sensor values.

the application to receive the data from the cloud.

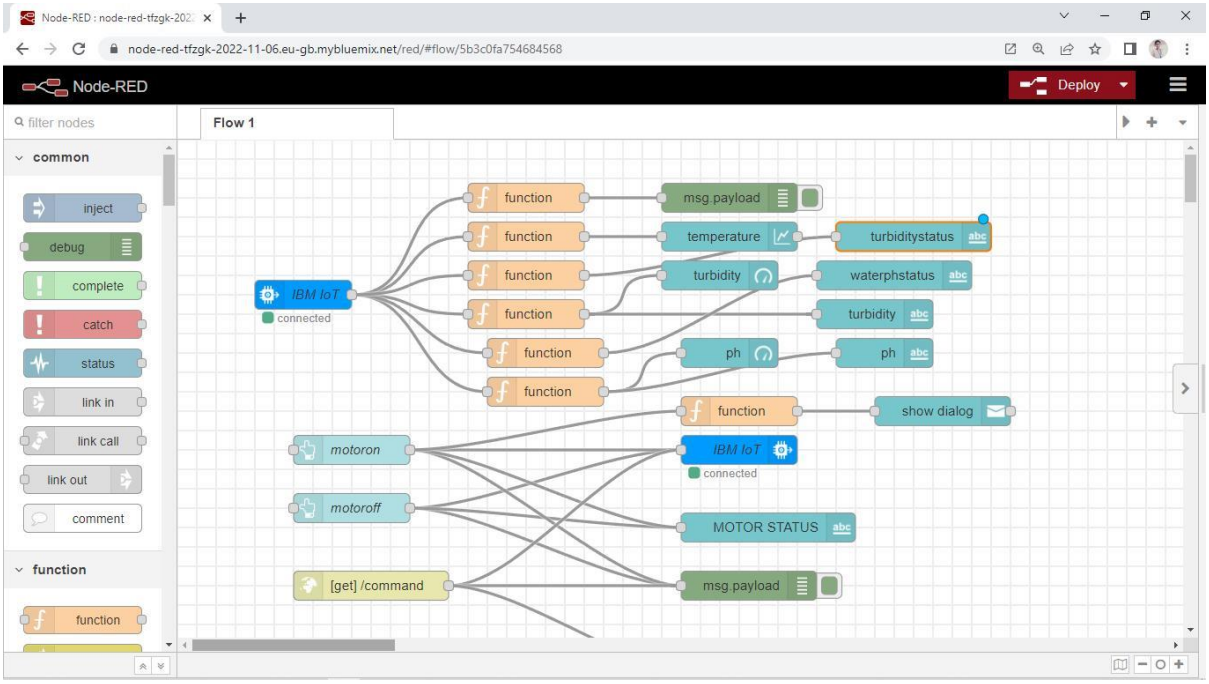
the mobile app to send commands to users using buttons.

Python code test code:

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
#Provide your IBM Watson Device Credentials
organization = "55i2ca"
deviceType = "riverwater"
deviceId = "12345678"
authMethod = "token"
authToken = "23452345"def myCommandCallback(cmd):
print("Command received: %s" % cmd.data['command'])
status=cmd.data['command']
if status=="motoron":
print ("motor is on")
state="motor on"
else :
print ("motor is off")
state="motor off"
try:
deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-
method": authMethod, "auth-token": authToken}
deviceCli = ibmiotf.device.Client(deviceOptions)
#.....
```

```
except Exception as e:
print("Caught exception connecting device: %s" % str(e))
sys.exit()
print("checking status of watson iot device ... connected .....sucessfully")
deviceCli.connect()
print("dear user ... welcome to IBM-IOT ")
while True:
waterph=random.randint(1,10)
temperature=random.randint(20,50)#random temperature in water
turbidity=random.randint(10,70)#random trubidity in water
if (waterph<5):
print("ph is low in water")
waterphstatus="low ph ,bad water"
elif(waterph>5)and(waterph<7):
print("normal ph in water")
waterphstatus="good ph,good water"
else:
print("normal ph in water")
waterphstatus="high ph,bad water"if (turbidity<30):
print("turbidity is low in water")
turbiditystatus="low turbidity , dust particles is low"
elif( turbidity>30)and(waterph<7):
print("normal turbidity in water")
turbiditystatus="good turbidity, dust particles is medium "
else:
print("normal turbidity in water")
```

```
turbiditystatus="high turbidity,dust particles is more "
data = { 'temp' :
temperature,'turb':turbidity,'ph':waterph,'waterphstatus':waterphstatus,'turbiditystatus':
turbiditystatus}
#print data
def myOnPublishCallback():
print ("Published Temperature = %s C" % temperature,"turbidity = %s %%" %
turbidity,"waterph = %s %%" % waterph )
success = deviceCli.publishEvent("espwatermodule", "json", data, qos=0,
on_publish=myOnPublishCallback)
if not success:
print("Not connected to IoTF")
time.sleep(5)
deviceCli.commandCallback = myCommandCallback
# Disconnect the device and application from the cloud
deviceCli.disconnect()
```



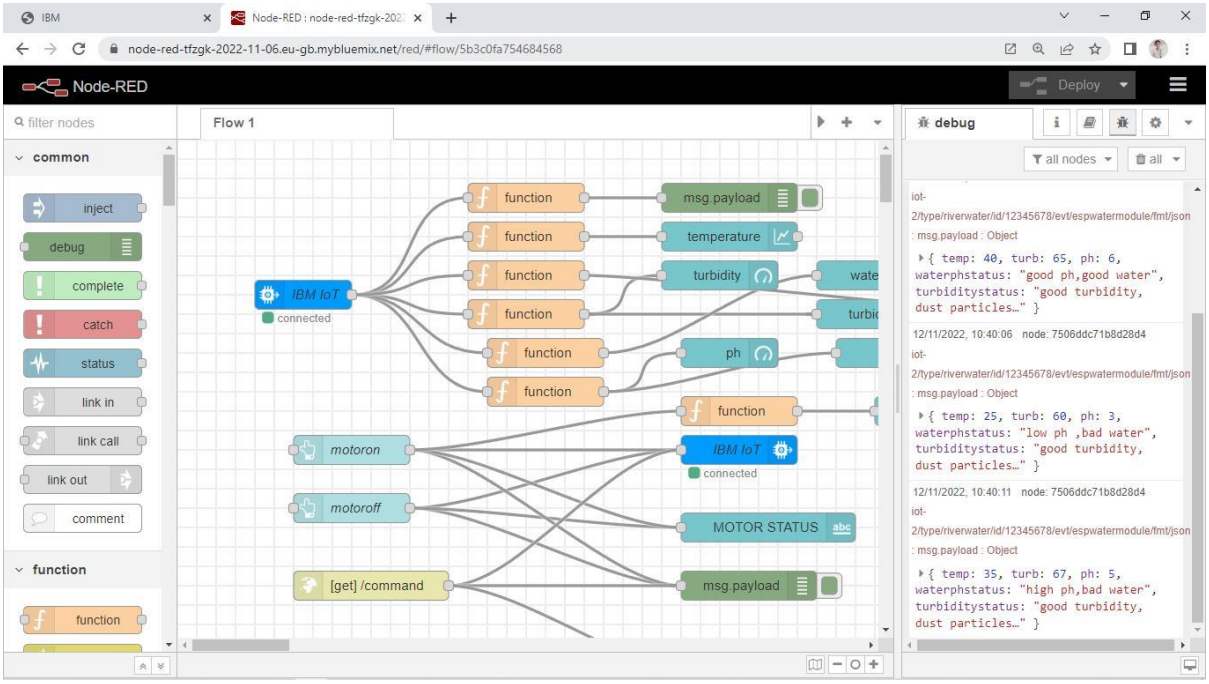


Fig 7.3.1 Data base Scheme

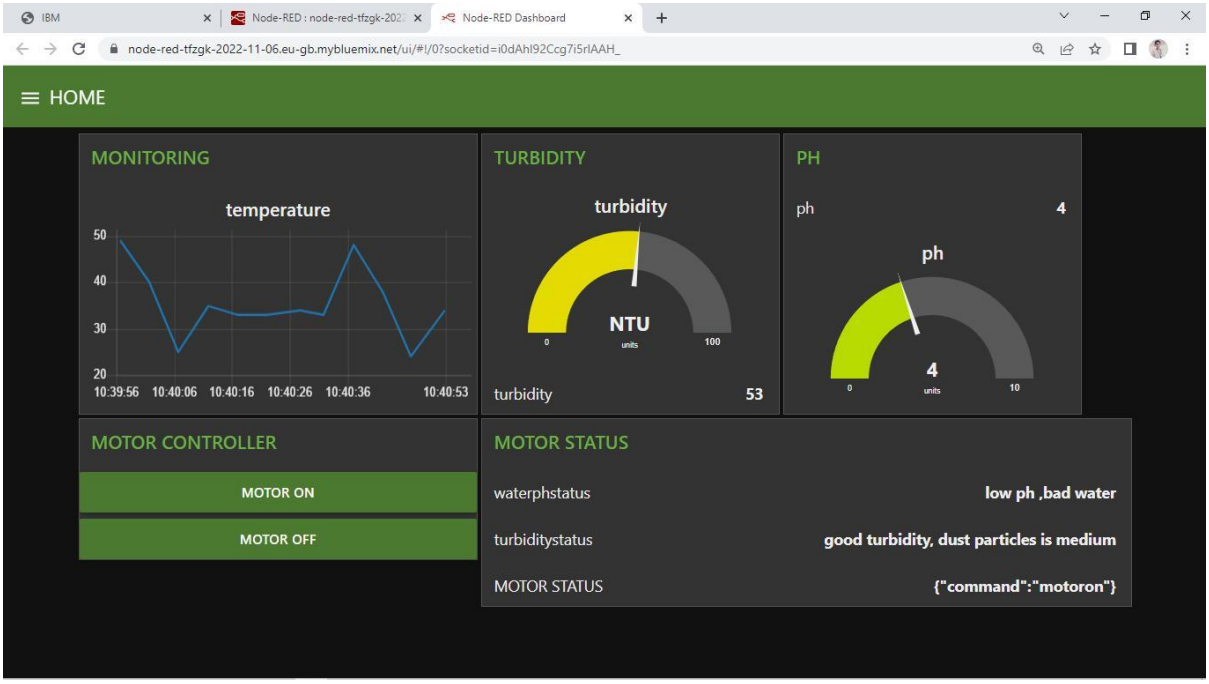


Fig 7.3.2 Data baes Scheme

MIT APP INVERTOR OUTPUT

Fig:7.3.3 Data base Scheme

Fig : 7.3.4 Data base scheme

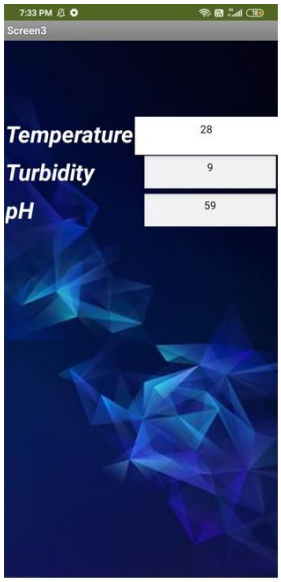


Fig:7.3.5 Data Base scheme

Fig:7.3.6 Data base scheme

8.TESTING

8.1 Test Cases

S.NO	Water parameter Values	Motor status	RESULT
01.	pH:7 Temperature:27 turbidity:12	Exhaust motorOn :TRUE	Passed
02.	pH:8 Temperature: 21 turbidity: 26	Exhaust motor on:TRUE	Passed
03.	pH:5 Temperature: 32 turbidity:37	Exhaust motor on:TRUE	Passed
04.	pH:2 Temperature: 20 turbidity:27	Exhaust motor off :FALSE	Passed
05.	pH:5 Temperature:34 turbidity:67	Exhaust motor on:TRUE	Passed
06.	pH:7 Temperature:25 turbidity:45	Exhaust motor on:TRUE	Passed
07.	pH:3 Temperature: 35 turbidity:31	Exhaust motor on:TRUE	Passed

08.	pH: 3 Temperature: 23 turbidity: 41	Exhaust motor on:TRUE	Passed
09.	pH:7 Temperature: 25 turbidity: 22	Exhaust motor on:TRUE	Passed
10.	ph: 9 Temperature: 32 turbidity: 36	Exhaust motor off:FALSE	Passed
11.	pH:9 Temperature: 27 turbidity: 28	Exhaust motoroff:FALSE	Passed
12.	pH: 7 Temperature : 27 turbidity: 19	Exhaust motor on:TRUE	Passed
13.	pH:4 Temperature :32 turbidity:45	Exhaust motor on:TRUE	Passed
14.	pH:6 Temperature: 32 turbidity:35	Exhaust motor on:TRUE	Passed
15.	pH:5 Temperature: 32 turbidity: 23	Exhaust motor on:TRUE	Passed
16.	pH:7 Temperature: 24 turbidity: 32	Exhaust motor on:TRUE	Passed

17.	pH: 3 Temperature: 32 turbidity : 18	Exhaust motor on:TRUE	Passed
18.	pH: 5 Temperature: 19 turbidity:34	Exhaust motor on:TRUE	Passed
19.	pH: 6 Temperature: 32 turbidity: 35	Exhaust motor on:TRUE	Passed
20.	pH: 7 Temperature: 36 turbidity: 28	Exhaust motor on:TRUE	Passed
15.	pH:5 Temperature: 32 turbidity: 23	Exhaust motor on:TRUE	Passed
16.	pH:7 Temperature: 24 turbidity: 32	Exhaust motor on:TRUE	Passed
17.	pH: 3 Temperature: 32 turbidity : 18	Exhaust motor on:TRUE	Passed
18.	pH: 5 Temperature: 19 turbidity:34	Exhaust motor on:TRUE	Passed
19.	pH: 6 Temperature: 32 turbidity: 35	Exhaust motor on:TRUE	Passed
20.	pH: 7 Temperature:	Exhaust motor on:TRUE	Passed

	36 turbidity: 28		
21.	pH: 7 Temperature: 28 turbidity: 39	Exhaust motor on:TRUE	Passed
22.	pH: 9 Temperature: 45 turbidity: 25	Exhaust motor on:FALSE	Passed
23.	pH: 5 Temperature: 34 turbidity:34	Exhaust motor on:TRUE	Passed
24.	pH: 6 Temperature: 34 turbidity:18	Exhaust motor on:TRUE	Passed
25.	pH:5 Temperature: 27 turbidity:20	Exhaust motor on:TRUE	Passed
26.	pH:9 Temperature: 32 turbidity: 21	Exhaust motor off :FALSE	Passed
27.	pH: 4 Temperature: 23 turbidity:67	Exhaust motor on:TRUE	Passed
28.	pH:5 Temperature: 28 turbidity: 37	Exhaust motor on:TRUE	Passed
29.	pH: 8 Temperature: 27 turbidity:15	Exhaust motor on:TRUE	Passed

30.	**pH:**4 TEMPERATURE :27turbidity**:**27	EXHAUST motor ON:TRUE	PASSED

8.2 User Acceptance Testing

1.Purpose of Document

The main purpose of our project is to evaluate the parameters of river water and respective control measures to be taken based on our test cases.The data are published in IBM cloud server.The UI is deployed in the Node Red services and app is developed using MIT APP INVENTOR

.

2.DefectAnalysis

This report shows the number of resolved or closed bugs at eachseverity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	9	5	4	3	21
Duplicate	2	0	2	0	4
External	3	4	1	2	10
Fixed	10	1	5	17	33
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	2	3
Won't Fix	0	3	3	1	7
Totals	24	13	17	25	79

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	15	0	0	15
Client Application	45	0	0	45
Security	1	0	0	1
Outsource Shipping	2	0	0	2
Exception Reporting	10	0	0	10
Final Report Output	4	0	0	4

9.RESULT

9.1 performance mertics

Performance measurement is the process of collectig uh,analzing and\or reporting information of the individual ,group ,organization, system or component .tend to be predicted upon an assumption about why the performancemeasured

Performance metrics are used to track process within a business .this is achieved using activities ,employees behaviuor ,and then used by empioyees to evalvate performance.this is an relation to on established goal such as employee productivity or sales objective

Three types of performance mertics

Graphic rating scales

Management by objectives

Forced raking

10. ADVANTAGES

- Sometimes detect underlying problems before they have an adverse effect
- Detect problems that affect a users productivity.
- Allow you to establish a baseline for the comparision.
- Collect data when problem occurs for the first time.
- While monitoring does not fix problem ,it does lead to more stable and reliable computer system
- Increased commitment by participants in success of problem.
- Resuiled arevmore likely to be acted on

DISADVANTAGES

- May be more challenging to facilities.
- Ethics and feelings of distruct.
- Cost in time and resources and risks.
- Improved productivity.
- Improved team performance .
- Increased internel security and protection from harassment.
- Requires invesment in evaluation training.

11.CONCLUSION

Real –time river water quality monitoring by using to T integrated big data analysis will immensely help people to becomes conclusion against using contained water as well as as to stop polluting the water .the research is conducted focusing on monitoring river water quality in real-time . therefore ,IoT integreted big data analysis is appered to be a better solution as reliability ,scalability ,speed, and persistance can be provided .during the project development ohase in intense comparative analysis of real-time analysis technologies such as spark streaming anaylsis through spark ML lib,Deep learning neural network models ,and beliefs rule based (BRB) system will be conduted[20-27]. This research would recommed conducting systamtic experimentation of the proposed technologies in diverse quanties of river water in bangladesh.

Due to the limatation of the budget ,we only focus on measuring the quality of the river water parameters .this project can be extended into an efficients water manangement system of a local area . demend and dissolved oxygen can be also quantified. So the additional budgetbis required for further improvement of the overall system.

AUTHOR CONTRIBUTIONS

Carried The work was out in collabrations between ll authors .all the uthors have accepted for the entire content of this submited manuscript and approved the submissions MUSC,TBE,SG,AP,MMA,NA,and AP colleted the water samples.

ACKNOWLEDGEMENTS

The authors are greateful to both department of computer science and engineering and depertment of pharmacy ,BGC trust university Bangladesh,chittagong-4381 ,bangladesh for providing the facilities this research .authors are also thankful to prof.

12.FUTURE SCOPE

It has widespread application and extension value.

Work can be carried on to include controlling

The system can be expanded to,

- **monitor hydrologic,**
- **air pollution,**
- **industrial**
- **agricultural** supply of water

13 .APPENDIX

SOURCE CODE

https://github.com/IBM-EPBL/IBM-Project-53830-1661499901/tree/main#ibm-project-53830-1661499901

Git Hub & Project Demo Link

https://drive.google.com/file/d/1PosJ_gxPqdvjrdMZxkvrARoaAaJgN9Zx/view?usp=drivesdk