International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 04 | Apr 2021 www.irjet.net p-ISSN: 2395-0072

EMBEDDED BASED REAL TIME MONITORING AND DETECTION OF BACTERIAL CONTAMINATION IN DRINKING WATER

J. Subhash[1], S. Mugilan[2], T. Mugilan[3], R.M.P. Mugilan[4], V. Prem Kumar[5]

Assistant Professor[1], UG Scholars[2, 3, 4, 5]
Department of Electronics and Communication Engineering
Adhiyamaan College of Engineering, Krishnagiri District, Tamilnadu, India
[1]subash.ece@adhiyamaan.in, [2]mugilansdpi@gmail.com, [3]mugiltamil07@gmail.com, [4]rmpmugil@gmail.com, [5]premjack004@gmail.com

---

ABSTRACT-- The sampling of microscope image of water and checking for the presence of harmful bacteria such as E. coli in water sources was developed in this research. A chromogenic enzyme substrate assay method was used to easily detect coliform bacteria by monitoring the color change of the sampled water mixed with a reagent. The image streaming to the data base of the end user. The liquid can be manipulated on and also can be observed by web camera feeds. Image streaming and web camera console run on python console window and serial communication with embedded processor with an UART board. The UART channel of the expansion board is connected to an external microcontroller board and relay is used to control water pipe line to sample the water, and check the water sample after the test is completed. The camera can repeat water testing until the test reagent is depleted. The authors anticipate that the use of the sensor node developed in this research can decrease the cost and required labor for testing samples in a factory environment and checking the water quality of local water sources in developing countries

Keyword-Microscope, Image, Bacteria, E.Coli, UART Board, Microcontroller, Test Reagent.
Microcontroller, Test Reagent.

I. INTRODUCTION

Coliforms are a group of oxidase-negative bacteria that produce acid from lactose or express β-galactosidase, and form yellow colonies of diverse shapes and sizes on membrane filters. Detection of coliforms in water or food samples is important as they serve as a good indicator for measuring the presence of other fecal origin pathogenic bacteria such as Salmonella spp or Listeria spp. Escherichia coli (E. coli) are a representative species among coliform bacteria groups. Properties such as fast growing time, low biological hazards at high concentrations after culture (while certain strains of E. coli can be pathogenic generally they are not), and well-studied physiological characteristics make E. coli a good marker bacteria for coliform detection. Many molecular or immunological mAethods for detecting E. coli have been developed. Previous studies using Polymerase Chain Reaction (PCR), Enzyme-Linked Immunosorbant Assay (ELISA), and antibody-conjugated gold nanoparticles (GNPs) have been introduced. Coliforms are a group of oxidase-negative bacteria that produce acid from lactose or express β-galactosidase, and form yellow colonies of diverse shapes and sizes on membrane filters. Detection of coliforms in water or food samples is important as they serve as a good indicator for measuring the presence of other fecal origin pathogenic bacteria such as Salmonella spp or Listeria spp.

II. LITERATURE SURVEY

The author in [1] **The designed a water quality monitoring system using WSN powered by solar panel**. The prototype system is designed and implemented using nodes powered by solar panels. Data from various sensors including pH, turbidity and oxygen density are sent to the Base Station (BS)The author in [6]. **Fault diagnosis using Wireless Sensor Networks (WSNs)** is one of the current

research areas in the field of water quality monitoring Achieving high fault diagnostic accuracy of water quality monitoring and controlling is a challenging task. A hybrid water quality monitoring device fault diagnosis model based on Multiclass Support Vector Machines (MSVM) is proposed. The author in [9]. They have used computer image processing technology and computer vision to analyze the fish behavior in real-time and predict the water quality. The sensors monitor the movement velocity, rotation angle, spatial standard deviation and body color which characterize the behavior changes of the fish. **Long Short-Term Memory (LSTM) neural network** is used to classify the parameters of the fish and predict the pollution of water

III. EXISTING METHOD

In existing method the E. coli concentrated at the reaction zone of the paper strip will react with custom formulated chemical reagents to produce a pinkish-red color. Such a color change on the paper strip when dipped into water samples indicates the presence of E. coli contamination in water. The performance of the Dip Test device has been checked with different known concentrations of *E. coli* contaminated water samples using different dip and wait times. The Dip Test device has also been tested with different interfering bacteria and chemical contaminants. It has been observed that the different interfering contaminants do not have any impact on the Dip Test, and it can become a potential solution for screening water samples for *E. coli* contamination at the point of source.

IV. PROPOSED METHOD

In this project, the data collected in image are used to determine the contamination of water and the results are analyzed. The implementation cost of the system is minimal. Moreover, efficient algorithms are also being used to coordinate the information collected the images and hence there is no data loss. The two phases of classification are training and testing. Training: It is the process of learning to the label from the examples. The training process can be either supervised or unsupervised. Here, the supervised mode is used for training. Testing: It is the process of checking how well the classifier has learnt to label the unseen samples.In addition to this we are developing automatic tap open and close operation with the help of electromechanical relay. The relay module is interfaced with microcontroller .The controller is connected to serial communication using UART. UART interfaced with laptop for detecting the bacteria's present in water or not. If the detecting the bacteria in water the relay will close the tap and control the water flow.

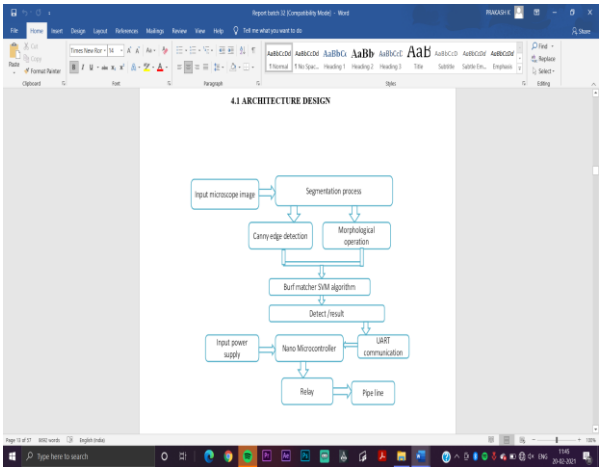

Fig 4.1 Block Diagram

V. WORKING PRINCIPLE

In existing method the E. coli concentrated at the reaction zone of the paper strip will react with custom formulated chemical reagents to produce a pinkish-red color. Such a color change on the paper strip when dipped into water samples indicates the presence of E. coli contamination in water. The performance of the Dip Test device has been checked with different known concentrations of *E. coli* contaminated water samples using different dip and wait times. The Dip Test device has also been tested with different interfering bacteria and chemical contaminants. It has been observed that the different interfering contaminants do not have any impact on the Dip Test, and it can become a potential solution for screening water samples for *E. coli* contamination at the point of source. Escherichia coli (E. coli) are a representative species among coliform bacteria groups. Properties such as fast growing time, low biological hazards at high concentrations after culture (while certain strains of E. coli

can be pathogenic generally they are not), and well-studied physiological characteristics make E. coli a good marker bacteria for coliform detection. Enzyme-Linked Immunosorbant Assay (ELISA), and antibody-conjugated gold nanoparticles (GNPs) have been introduced. The designed a water quality monitoring system using WSN powered by solar panel. The prototype system is designed and implemented using nodes powered by solar panels. Data from various sensors including pH, turbidity and oxygen density are sent to the Base Station (BS). The system has advantages such as low carbon emission and power consumption and flexible deployment

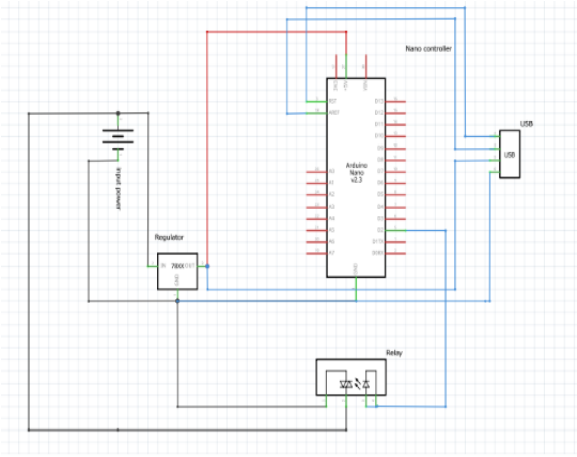

Fig: 5.1 circuit diagram

VI. RESULT AND DISCUSSION

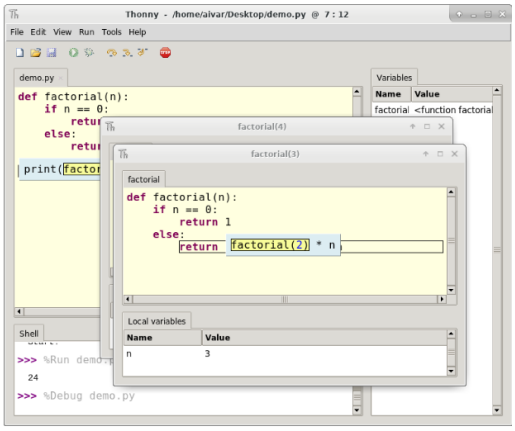

Fig: 6.1 display result

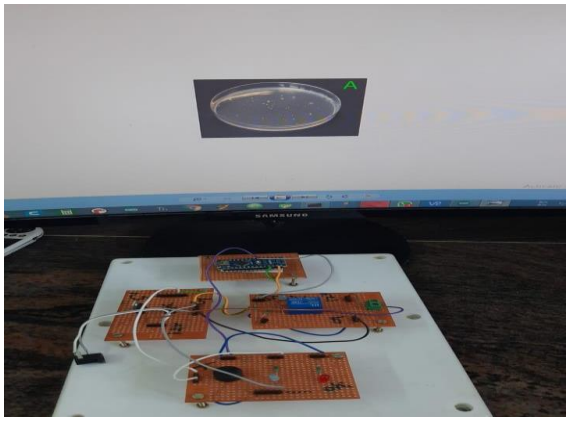

Fig.6.2 experimental result

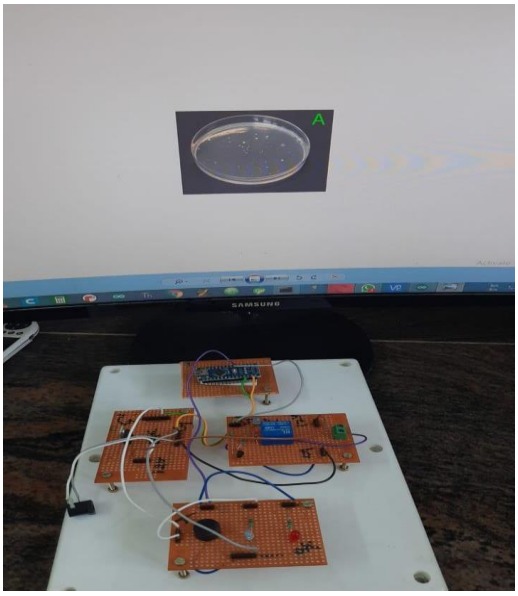

Fig.6.3 experimental setup

Escherichia coli (E. coli) are a representative species among coliform bacteria groups. Properties such as fast growing time, low biological hazards at high concentrations after culture (while certain strains of E. coli can be pathogenic generally they are not), and well-studied physiological characteristics make E. coli a good marker bacteria for coliform detection. Many molecular or immunological methods for detecting E. coli have been developed. Previous studies using Polymerase Chain Reaction (PCR), Enzyme-Linked Immunosorbant Assay

(ELISA), and antibody-conjugated gold nanoparticles (GNPs) have been introduced.

VII. CONCLUSION

The Embedded based real time monitoring presented in this project can perform automated analysis to determine whether or not bacterial contamination are present in treated water supply. The system can reliable determine the presence of microorganisms and enable the sample to be accurately and efficiently reviewed by an operator if required. The implemented algorithms accommodate bacterial contamination in drinking water ain hardware system the relay is activated if the water is dirt less.. The Dip Test device has also been tested with different interfering bacteria and chemical contaminants. It has been observed that the different interfering contaminants do not have any impact on the Dip Test, and it can become a potential solution for screening water samples for *E. coli* contamination at the point of source. Each method has its respective strengths such as speed and accuracy; however, the process for detecting coliforms generally takes place in food factories, which have to deal with large numbers of daily samples, or in nations with developing economies where access to clean water is limited. In this project check the water is dirt (bacterial contamination) or dirt less based on image processing. The dirt water images and pure water images is trained using algorithms. The input image is segmented using segmentation process. The canny edge detection is done for edge detection. If the dirt water is detected the relay will close the pipeline. if the water is dirt less the relay will activate the pipeline.` check the water is dirt (bacterial contamination) or dirt less based on image processing.. The input image is segmented using segmentation process. The canny edge detection is done for edge detection. If the dirt water is detected the relay will close the pipeline. if the water is dirt less the relay will activate the pipeline.

REFERENCE

[1] Lee, R.J. “Methods for the Isolation and Enumeration of Coliform Bacteria and Escherichia coli (including E. coli O157:H7). In The Microbiology of Drinking Water”; Government of the United Kingdom, UK, 2017; pp. 9–10.

[2] Naga, S.K.G.; Selvaraj, N.; Sujit, S.; Sanjay, K.; Sandhya, S.; Sushanta, M. Mobile Water Kit (MWK):” A Smartphone Compatible Low-Cost Water Monitoring System for Rapid Detection of Total Coliform and E. coli.” Anal. Methods 2016, 6, 6236–6246.

[3] Yoon, J.Y.; Kim, B. Lab-on-a-Chip Patho Yoon, J.Y.; Kim, B.” Lab-on-a-Chip Pathogen Sensors for Food Safety”. Sensors 2017, 12, 10713–10741.

[4] Ali, M.A.; Eldin, T.A.S.; Gihan, M.M.; Islam, M.T.; Omara, I.I. “Detection of E. coli O157:H7 in Feed Samples Using Gold Nanoparticles Sensor”. Int. J. Curr. Microbiol. Appl. Sci. 2018, 3, 697–708.

[5]Ali, K.Y.; Muhammad, S.A.; Christopher, R.L. “Paper-Based Microfluidic Pointof-Care Diagnostic Devices. Lab Chip” 2018, 13, 2210–2251.

[6] Lee, J.H.; Gim, Y.S.; Lee, S.W.; Ko, S.H.; Chun, J.M.; Oh, H.S. “Research on Enzyme Substrate Test Kit Development for Detection of Total Coliform and Esherichia coli”. Rep. Inst. Health Environ. 2019, 18, 7–14.

[7] John Mackrory and Mark Daniels,” The impact of new technology in machine vision” Sensor Review, vol15, No1, 2017, pp8-11.

[8] H V .Smith and L B Rose. (2017). “Waterbome Cryptosporidiosis”. Parasitol. Today, 6, pp 8-12.

[9] H V Smith and L B Rose (2018). “Waterbome cryptosporidiosis: Current status”. Parasitol. Today 14, pp 14-22.

[10] H. L. Fernandez-Canque, S Bota, B Beggs, E Smith, S Hintea,H Smith “Automatic Detection System for Cryptosporidium”. Proc. of EMBEC’02 (2016) - 2nd European Medical and Biological Engineering Conference Vienna, Austria. 2016. p 662-667.

[11] P E Danielsson, F Nilsson” Finding the Minimal Set of Maximum Disks for Binary Objects”, Graphical Models And Image Processing, 59, pp. 55–60.