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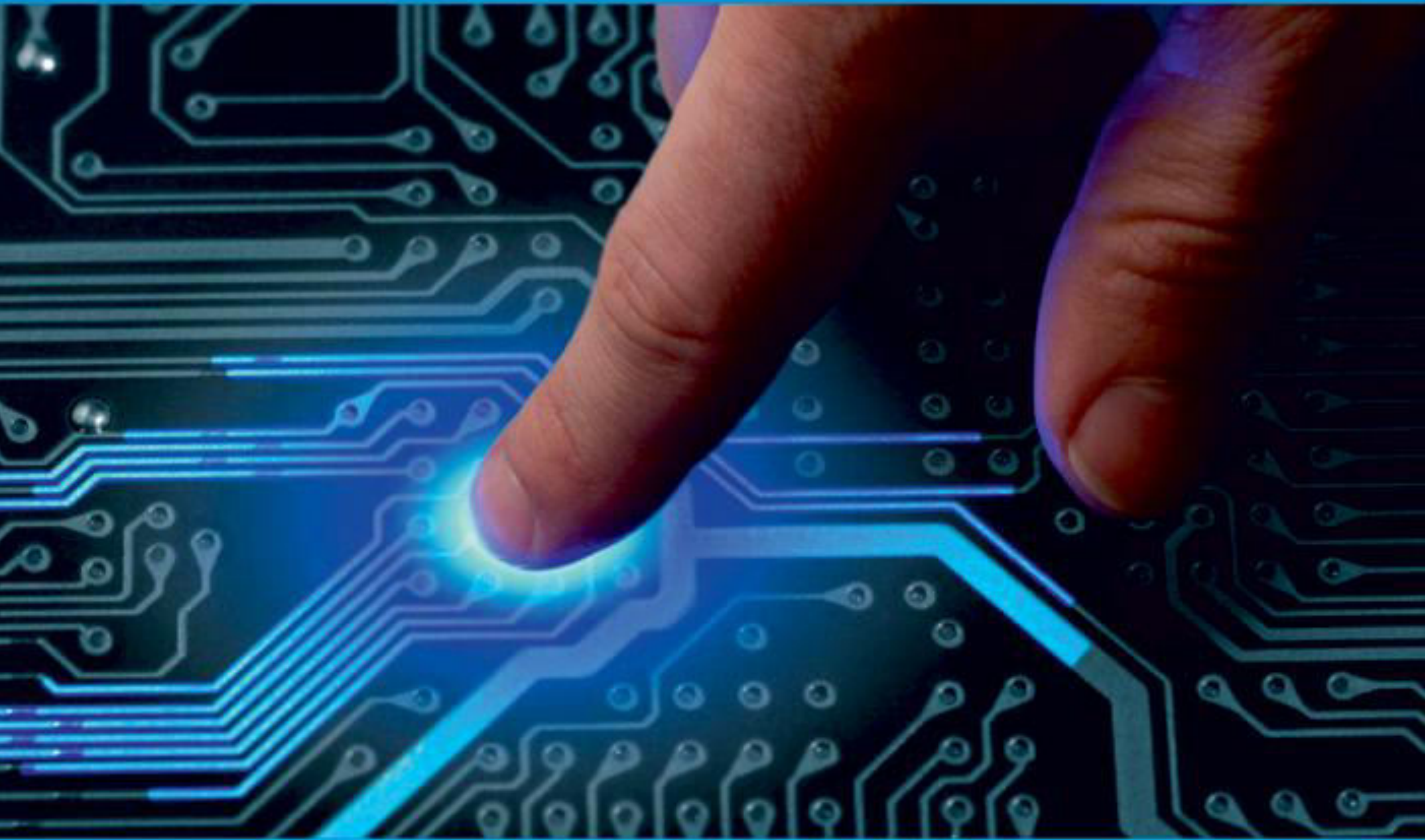

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Doctor Pipes: A Leakage and Crack Detection Robot

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ABSTRACT: All pipe networks on the planet may confront leakage and blockages issues because of various reasons and this can prompt asset wastage, monetary loses, injuries and in most pessimistic scenarios may likewise lead to the death of individuals. The seriousness of the damage caused may rely upon the sort of material that is being shipped in the pipe. In these situations, it turns out to be crucial to distinguish the leaks and blockages and fix it before any huge accident takes place. Given the fact that these pipes are in some cases inaccessible by the people, it's anything but an immense exertion to recognize the leakage and to arrive at the leakage point as quickly as possible to minimize further damage. Considering the above state of affairs, this paper presents a portion of the current employed methodologies alongside the proposed approach for leakage and blockage detection and correction. It also discusses the progress made in the past and ongoing exploration. Keywords— pipe leakage, leak detection, pipeline, water distribution system, pipe inspection robot.

I. INTRODUCTION

Water is a daily necessity for life, wellbeing, economy and the environment. As water is valuable to everybody, its accessibility and quality is fundamental. Environmental change, dry seasons, water deficiencies and populace development are expanding the strain on existing water assets, thereby expanding the need to safeguard and stay away from water wastage through compelling administration and decrease of water misfortunes. A lot of water is lost in the water supply framework. Water leakages have been a significant issue in numerous areas around the country. In certain areas, water wasted due to leakages has surpassed 40% of total water in the supply framework. Decrease of water leakage is a significant objective, as it willdecrease the measure of cash and energy needed on creation and siphoning water and furthermorefulfillment of consumer needs through more developed and unwavering quality of the framework. In many water dissemination frameworks, a huge percentage of water is lost while on the way from treatment plants to consumers. As per a study made in 1991 by the International Water Supply Association (IWSA), the sum of lost or "unaccounted for water" (UFW) is regularly in the scope of 20–30% of production (Cheong 1991). In case of a few frameworks, for the most part older ones, the level of lost water could be pretty much as high as half of the production (AWWA 1987). Holes in pipelines, regardless of whether for oil, gas, or water, is a very common issue in framework around the world. Blockages occur due to various reasons like waste material getting struck in pipeline system, presence of animal creatures inside pipe, etc. Leakage regularly happens in various parts of the pipeline framework. Pipeline networks are the most economic and most secure method of transportation for oil, gases and other liquid items. As a method for significant distance transport, pipelines need to satisfy high requests of security, unwavering quality and productivity. Assuming good upkeep, pipelines can last indefinitely without leaks. Most of the significant damages to pipelines are due to nearby excavations. In the event that a pipeline is not maintained properly, it can corrode, especially at joints, recessed spots where dampness gathers, or areas with flaws in the pipe. Nonetheless, these deformities can be distinguished by assessment instruments and adjusted before they progress to a break. The investigation of pipelines might be pertinent for further developing security and proficiency in modern plants. These activities such as investigation, support, cleaning and so on are costly, therefore the utilization of the robots seems, by all accounts, to be perhaps the most alluring arrangement. Pipeline leak and obstacle detection frameworks are systems used to recognize leak of materials from thepipelinein order to alert the operator and obstacles and tries to remove it. Leak recognition is a fundamental part of pipeline hazard management as it permits the administrator to react on schedule to the leaks to forestall further escalations. Various technologies are available to identify the hole from pipelines, depending upon the fluid in the pipe and the hole size. These range from fundamental material equilibrium procedures to considerably more muddled frameworks. The paper is organized as follows

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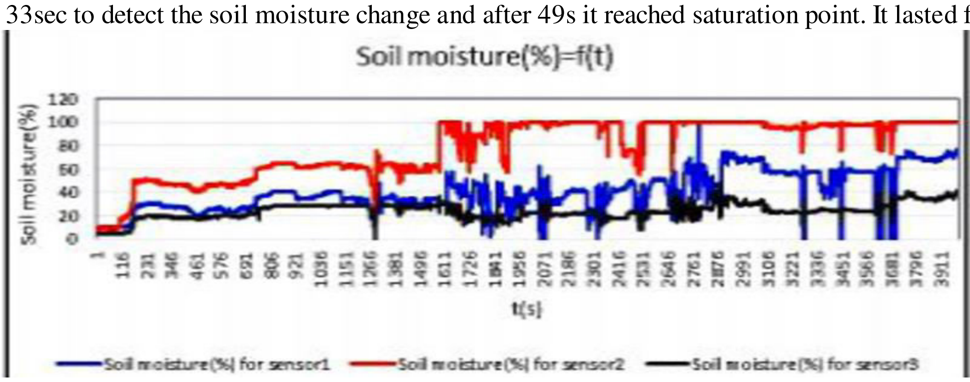
II. LITERATURE SURVEY

1. LISTENING METHOD

The primary identification technique dependent on listening was presented during the 1850s the manual sounding strategy includes putting a wooden listening bar on the available contact points of the water pipeline framework and fittings, for example, fundamental valves or hydrants the listening pole is utilized to identify the sound coming about because of spilling water and from compressed lines where it works correspondingly to the stethoscope utilized by specialists to pay attention to the heart when a commotion is distinguished holes are pinpointed by tuning in at the ground surface straight over the pipeline at little spans along the water pipeline framework the utilization of conventional strategies, for example, listening gadgets is clear and economical anyway listening strategies are tedious and have problematic adequacy moreover solid doesn't go along non-metallic lines, for example, asbestos concrete lines.

2. IOT BASED METHOD

In this method an IOT architecture is developed to which different types of sensor nodes and smart devices are connected. All the devices of the dynamic systems are interconnected. In the experimental runs, a variety of different leakage scenarios were executed and three different location leakage incidents were examined. The leakage detection time was found for the three sensors placed. In the soil moisture experiment for the first leakage scenario, the water was poured at a distance of 1 cm from the soil moisture sensor and lasted for 465s. The total water poured was1L and it took 5min and 33sec to detect the soil moisture change and after 49s it reached saturation point. It lasted for 465s.



Fig(1)Soil moisture values for three sensors

In the second leakage scenario, the same amount of water was poured as in the first and lasted for 13min 32s. It is observed that it took 13min 21s to reach the saturated point. In the third leakage scenario, the water was poured at the distance of 12.5cm from soil and lasted for 52mins 13s. The total water poured was 2L and it took 40mins 12s to reach saturation point. But these three experiments were not sufficient to detect soil moisture change.

3. SPAMMS

An epic financially savvy versatile adjustable and self-governing sensor-based framework called spamms which joins detecting advances with robot is proposed in this technique specialist based advancements for proficiently finding wellbeing related occasions is utilized and it permits dynamic and restorative observing and support of any sort of pipeline frameworks the outline of the pipeline framework utilized in spamms recreation is as per the following it comprises of 26 pipeline sections one upstream station and one end siphoning station the portable sensors are floated to the pipeline from the upstream station also the movement to them is given by the liquid shipped through the pipeline the floated portable sensors are gathered for occurrence limitation and further preparing toward the end siphoning station this strategy initially determine the ideal qualities for the quantity of fixed sensors that ought to be introduced number of examination history data that can be obliged the number of portable sensors and the quantity ofjumps that are ideal to store the episodes data when they are identified it likewise included determining a calculation to gauge the qualities of versatile sensors while they are floating inside the pipeline at the point when portable sensors go through the rfid labels in each fragment they arbitrarily pick two rfid labels accessible in that fragment and compose their character data which give the following data to all versatile sensors went through that specific fragment fixed sensors or labels joined inside the pipeline give restriction to the versatile sensors and robot specialists by sharing their area data the fixed sensors store the set of experiences data of versatile sensors andhelp the robot specialists discovering episodes

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announced by portable sensors the portable sensor attempts to write in the first accessible rfid tag until hop2 after hop2 it arbitrarily chooses a label dependent on some arbitrary number generator and stores on the tag gave that it is inside the leftover distance by erasing its most seasoned section.

The critical advancements of spamms are 3-overlay a the framework can apply to a huge assortment of pipeline frameworks b the arrangement gave is practical since it utilizes minimal expense feeble fixed sensors that can be arrangement while the pipeline framework is working c the robot is independent and the confinement procedure permits controllable mistakes the reenactment tests depicted in this paper alongside prototyping exercises exhibit the attainability of spamms this arrangement may not be adequate to help high data transmission on account of huge moment data is gathered and ensure radio correspondence coherence these frameworks are uninvolved in the manner that they just report on episodes and don't add to their fixing rfid labels have limited limit just 50 passages to store history furthermore episode data during the pipeline investigation.

4. Fully Autonomous Pipe Assessment Mobile Robot "KANTARO"

In this, an innovative, fast and solid sewer appraisal system has been proposed by using a uninvolved unique shrewd, totally independent, untethered robot, called "KANTARO", which fits to the lines inside a width extent of 200-300 millimeters. KANTARO model robot, checking a novel standoffish powerfulsharp moving framework (naSIR instrument), has a good improvement into the straight line and smooth and quick development while passes different kinds of line turns without need of any information on the controller or sensor scrutinizing. In this technique KANTARO doesn't request any kind of sensor for its development inside the line. Also, a little and insightful 2D laser has been made. A scanner for perceiving of the navigational achievements, for instance, sewer vents and line joints self-rulingly with basic PC structure and mix with a fish eye camera, mounted on the KANTARO, used for reviewing the line state and inadequacy acknowledgment is furthermore associated with this. Affirmation of KANTARO as a totally free, strong and incredible line evaluation robot has been refined by arranging a designing ward on understanding at its modules and definition and execution of a day to day existence optic untethered connection to make the examination measure successfully and safely.

The obstacle is that it can essentially fit to the lines inside a width extent of 200-300 millimeters. A huge part of these robots have a complex moving framework and multi-sensor equipment for course and development control. These complexities in framework and data planning make hard to recognize reliable business things. Limitation is an issue not only for the suitable robot control, so the robot knows where it is, yet moreover for evaluation, as distinguished damages must be represented with their space. The sensors used for development course may cover with the survey sensors (for instance a camera may be used for both development course and damage revelation). The different structures do prohibit sensors for finding hurts or assessing the line state, notwithstanding just sensors to warrant their ensured course and control. Assessment of the line condition and Shortcoming Navigation may be performed not entirely ready, or separated after recuperation of the recorded unmistakable data. Robots have a staggering framework moreover, a couple of sensors for recognizing the line curves besides, pass them. These complexities in instrument moreover, data planning makes hard to sort it out reliable business things. The start and prevent cooperation of saving data from camera and switch on/off the laser scanner play out a more drawn-out survey measure where the constraint of hard plate besides, energy usage is considered.

III. PROPOSED METHODOLOGY

In order to achieve the objective, we construct a robot with all the needy sensors mounted on its chassis to detect the cracks and obstacles present in the pipe once the robot is fed inside the pipeline. The robot also tries to remove the obstacle using the driller nail mounted in front of the robot.

The mechanism for detecting obstacles and cracks are as mentioned below:
1) The crack detection is done using the LDR sensor.
2)The obstacles are detected using IR sensors.
3)Obstacles are removed using the driller operation which gets activated upon detecting obstacles.
4)The code required to detect the obstacles and cracks is developed using Arduino IDE and dumped into the Arduino Nano Board.
5)The movement of the robot is synchronized using the mechanical parts and motor drivers. The movement is possible due to the presence of wheels in the robot.
6)Wireless transfer of the information is possible using the ZigBee module. The information about the detection of obstacle/crack is being transferred to the operator's system using the ZigBee module.

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7) A PVC pipe of six inches diameter was used for testing the pipeline inspection robot.
8)Forward and backward movement of the robot is possible due to the presence of H-Bridge. The robot will move according to the input provided by the operator.

IV. ADVANTAGES OF INSPECTION ROBOT

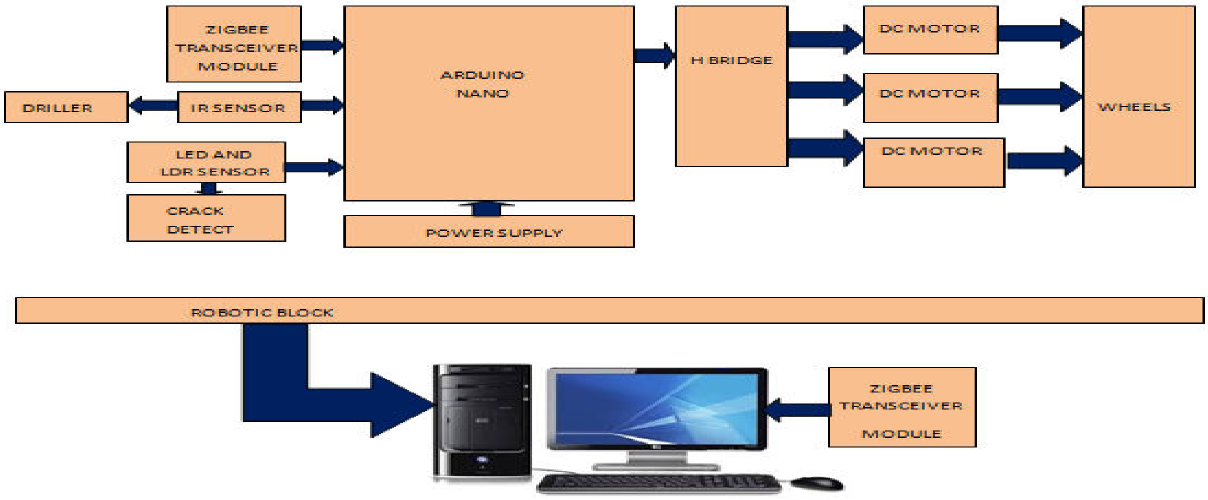
1)Accurate detection is possible.

2) Improves work efficiency.

3) Easy to operate.

4) Results will be displayed on the screen.

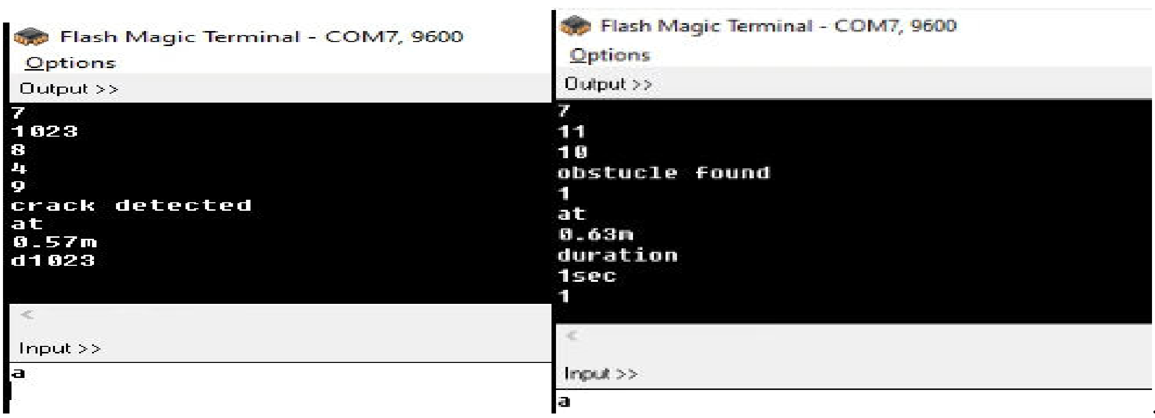
5) Cost effective.



Fig(2) Block Diagram

The robot is inserted inside the pipeline with all the sensors intact on the chassis. The LDR is responsible to detect the cracks. Once a crack is detected, the robot stops at the spot of crack and sends the information to the operator using ZigBee. When an obstacle is detected then the robot stops and the drilling operation starts and the robot tries to clear the obstacle. We can control the movement of the robot in forward or backward direction by wirelesslytransferring the command to the robot.

V. RESULT



Fig(3) Crack detection and Obstacle detection

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LDR will be sensing the value of intensity falling on it throughout the pipe starting fromthe initial position.If the LDR sensing value is found changing according to the required condition the robot stops at the spot and message is transferred to the operator's screen. Else the robot moves on and the output signal is given on the terminal.
When the IR sensor detects any object/obstacle then the driller operation starts and the information is sent to the operator using the ZigBee module.

VI. CONCLUSION

In this paper, a survey on the existing technology to detect cracks is discussed. It is clear from this survey that thepresent technologies have different accuracies, cost anddifferent methods of deployment. All the scopes of development are also discussed in the survey. The adoption of a specific technology depends on the type of application requirement. This paper also offers a solution for obstacles detection andclearance.A lot of research is being conducted for leakage detection,as a high percentage of loss of water is caused due to leakageof pipes.

VII. FUTURE SCOPE

The consequence of the fixing pipe spillage analyze underline that the undertaking can succeed and can likewise be additionally evolved later on. The examination likewise researches some future upgrades that can be applied to have an improved rendition of the fixing robot by making it reasonable to move in different dimensions of pipe and also to various bends andjoints, as it can be extended to various industries whereinpipes are involved such as:
1. Drinking water pipelines
2. Nuclear power plant
3. Conventional power plant
4. Refineries
5. Chemical and petrochemical plant

REFERENCES

[1] Kazeem B. Adedeji1, Yskandar Hamam1, Bolanle T. Abe1 andAdnan, M. Abu-Mahfouz1,2. "Burst Leakage-PressureDependency in Water PipingNetworks: Its Impact on LeakOpenings" 2017
[2] Dvajasvie.G, Farisha Banu PK, Sachin Babu, Saheen K P, NikhilBinoy C"Leak Detection in Water-Distribution Pipe System",second international conference on intelligent computing andcontrol system, 2018
[3] Meter Reading Technology Elias Farah, Isam Shahrour "SmartWater for Leakage Detection: Feedback about the Use ofAutomated". 2017.
[4] "A Review of Vibration Detection Methods Using AccelerometerSensors for Water Pipeline Leakage", 2019
[5] Tianhu Xu, Zhoumo Zeng, Xinjing Huang*, Jian Li, Shili Chen,Xiaobo Rui"Experimental investigation on acoustic characteristics of smallleakages in metal water pipe for in-pipe inspections", 2019.
[6] Jiao SB, Fan L, Wu PY, Qiao L, Wang Y, Xie G. Assessment ofleakage degree of underground heating primary pipe networkbased on chaotic simulated annealing neural network. In ChineseAutomation Congress (CAC), 2017 2017 Oct 20 (pp. 5895-5900).IEEE.K. Elissa, "Title of paper if known," unpublished.
[7] S. Li, J. Wu, Z. Xu, and L. Li, "Unascertained Measure Model ofWater and Mud Inrush Risk Evaluation in Karst Tunnels and ItsEngineering Application," *Ksce. J. Civ. Eng.*, vol. 21, no. 4, pp.1170-1182, 2017.
[8] K. B. Adedeji, Y. Hamam, B. T. Abe, and A. M. Abu-Mahfouz,"Towards Achieving a Reliable Leakage Overview, "*IEEE Access*,vol. 5, September 2017.Detection and Localization Algorithm forApplication in Water Piping Networks: An Overview, "*IEEEAccess*, vol. 5, September 2017.
[9] Fuchs, H. V., and R. Riehle. "Ten years of experiencewith leakdetection by acoustic signal analysis." Applied Acoustics 33.1(1991): 1-19.

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