MULTIPURPOSE BOT FOR PIPELINES INSPECTION AND MONITORING

Soumya Sahu , Saurabh Swarnkar

Chhattisgarh swami vivekanand technical university,
Department of Electrical engineering, shri shankaracharaya technical campus
Junwani, Bhilai-490020(C.G.), INDIA

ABSTRACT - Nowadays, technology is upgrading promptly, so it's highly important to upgrade ourselves and our surroundings with new technologies. Today industries are moving towards automation from manual work. There is a machine for every work which is dangerous for a human to do or unreachable by them. A pipe is also one of the tools that are highly used to transport fluids from one place to another. There is a large channel of pipelines in industries that require maintenance and inspection from time to time. Although it is difficult to inspect the narrow pipes from inside. Here in this paper, we focused to design a wireless bot using microcontrollers and sensors to detect faults inside the pipelines and notify the user on their smartphones.

***KEYWORD* :** *Sensor, Multipurpose, Bot, Pipelines , Inspection, Wireless.*

INTRODUCTION - Robotics, automation, and wireless sensing are the future of industries. These all together are highly beneficial for us as they reduce human effort in an area that requires major precautions and is unreachable by humans. It also saves our time, expenses and provides additional safety at the workplace. The best use of the bot is to explore the area which is unreachable by humans like inner and narrow spaces. In industries all around we find narrow pipelines and small components which together form large machines. Pipes and machines require a bot for inspecting damages and defects. Pipes are mostly made up of steel which is prone to
corrosion, cracks, and unnecessary blockage by the external environment. From our homes to

industries everywhere pipelines are used for the transportation of water, gas, oils, sludge, etc. “Bhopal gas tragedy” is one of the haunting incidents in the history of India thousands of people, hundreds of other living organisms died overnight and it also harms nature. The cause of the accident is nothing but the leakage of methyl isocyanate gas from the pesticide factory. To prevent accidents and interruption in work regular inspection of pipelines is needed. Acoustic sensors, smart pigs, odor, and colorful chemicals are added to fluids, etc. are various expensive techniques are used to detect the faults inside the pipelines. All this incident stimulates us to find the solution to this problem. In the end, we design a multipurpose bot for inspection of pipelines from inside. In this, we used different sensors as per the requirement of pipelines. The size of a bot is a major challenge in this project. Pipes are long narrow tubes that differ in shape and size. A palm-size bot can be used where ever it is needed for inspection.

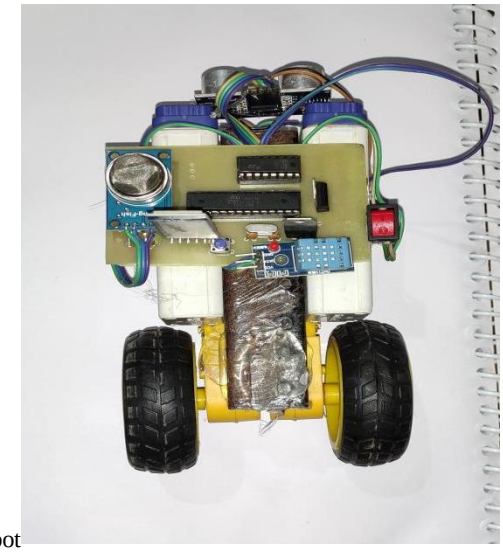


Figure-1: Image of bot

LITERATURE REVIEW - Inspection of pipelines from inside is always a point of concern in industries or where ever pipelines are present. So great quantities of work are done to inspect the pipe. Rafael R. Marangoni et al.[3] design a remote control video inspection bot and developed software for controlling it. They used a USB camera that capture an image and sent it to the operator.Sami Salama Hussen Hajjaj et al.[8] made a caterpillar-type robot so that it will move or crawl inside the pipe their main concern is to detect oil and gas leakage in pipes. Md. Rawshan Habib et al.[1] Work on a project to build a wire-based bot that moves both horizontally and vertically inside the pipe to inspect the faults and is able to grab things during the rescue operation. Jong-Hoon Kim et al.[6] try to solve the problem using sensor and robot technology with the help of RFID (radio frequency identification), in this the sensor used radio signal to provide information of faults in pipelines. Muqdad Kh. Sedkhan et al.[9] aim to prevent the tampering of oil and gases from the pipelines. With the help of a sensor at the node of pipes, they are able to detect the vibration in the pipelines in this they focus on the 4 scenarios that are cutting, hammering, knocking, and drilling. E. N. Aba et al.[10] used mathematical algorithm to work on real-time pipeline monitoring system as fault cause due to momentary event and generate a pressure pulse in both the direction of pipes, with the help of Fourier series point of an incident is calculated. Deepak Sonawane et al. [11] design solid work to stimulate a bot for pipe inspection. They were able to see the actual image inside the pipelines.

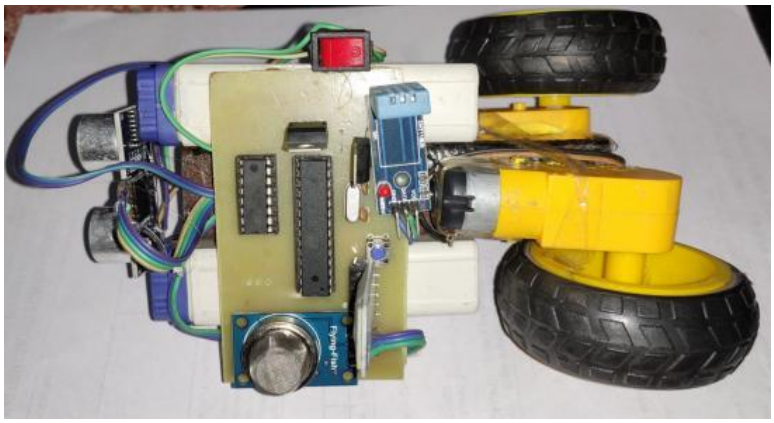
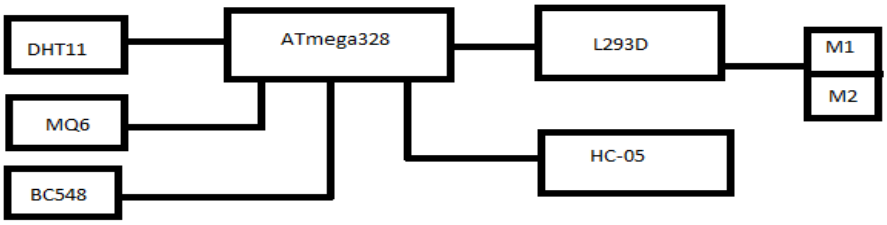
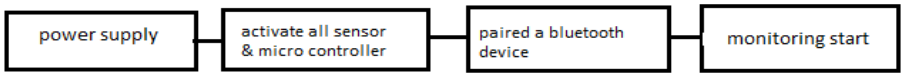


Figure-2: wheel arrangement of wheel

METHODOLOGY - To design a complete bot, from its structure to its operation, we need an ATmega328 microcontroller to provide an interface between hardware and software. The embedded C programming language is used to program this system. The L293D motor driver is capable of driving the motor in both directions. A BO motor is used to provide a good rpm and torque. The HC-05 Bluetooth device provides wireless functionality to the system. This device can be used in a personal area network (PAN) up to 10 meters in range. It operates via serial port protocol (SPP). Several fluids in industries require a certain range of temperature and humidity, so here DHT11 sensors are used to measure the temperature and humidity in pipelines, it measures a temperature range of 0 to 50 degrees Celsius and a humidity range of 20% to 90%. One more sensor used in this system is the BC548 ultrasonic sensor, whose range is up to 10 meters. Using this sensor, it is possible to locate blockages inside the pipelines and pinpoint their exact location. Lastly, the MQ6 gas sensor is used in this system, which is capable of detecting isobutane and propane gas.

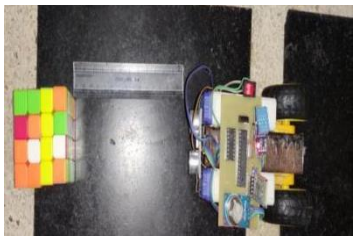


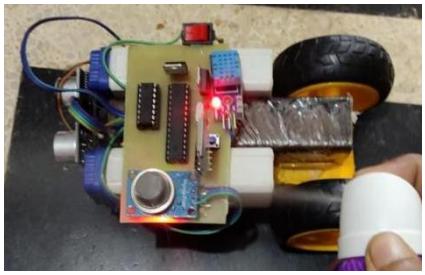
In designing and assembling the bot, we encounter many challenges like proper fixing of wheels, circuit design, etc. after resolving these challenges, we are able to see a fully functional prototype. The size of the bot is 18 cm long and 8.5 cm wide. It can move inside a pipe with a radius of approximately 7cm.Once the power is supplied, the robot starts up, activating the sensors, Bluetooth device, and microcontroller. It is connected to a mobile app to monitor and control the bot in real time.. Every second data from the bot is transmitted to the mobile device.

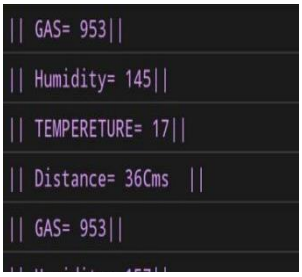


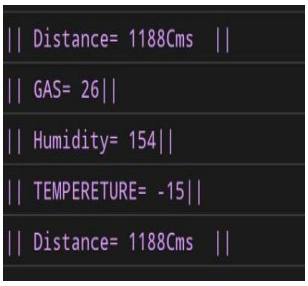
RESULT DISCUSSION -

Demonstration of the prototype gives a following results as shown in below figure









CONCLUSION - The pipe inspection bot is successfully developed and designed after analyzing many solutions to the problem. The bot is able to inspect the defect inside the pipelines and notify the user. Sensors play an important role in it. There is always a small difference between the idea and the actual condition of the project, and this project was also a little bit deviated from the original plan. Experimentally, it achieves its objective of creating a palm-sized bot for pipelines inspection.

The name "multipurpose bot" suggests that this device has a wide range of applications. We can use it in locations other than pipelines. This gadget is limited to Bluetooth communication but, as technology advances, we can adapt it to an IoT-based monitoring system. Sensors play an important role in this device, and by replacing them with different sensors, they can be used for other purposes as well, such as detecting faults in underground cables with magnetic field sensors, and designing a bot in the shape of a snake to move inside the underground cables, and so on.

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