

## KROTO FINDER- DETECTION OF DAMAGES IN OIL/GAS PIPES

<sup>1</sup>Thanuja I K, <sup>2</sup>Sheeba Kumari M, <sup>3</sup>Vineeth Reddy M,

<sup>1</sup>Dept. Of ECE, New Horizon College of Engineering,  
Bengaluru, India.

<sup>2</sup>Dept. Of ECE, New Horizon College of Engineering,  
Bengaluru, India.

<sup>1</sup>Dept. Of ECE, New Horizon College of Engineering,  
Bengaluru, India.

### ABSTRACT

*This project is mainly implemented for industrial applications for detecting the damages inside the oil pipe that cannot be detected by human beings. KROTO is a Greek word which means 'to crack'. The interior of the pipe has a very high temperature, high pressure and contains toxic gases. So the cracks in the pipe are detected and the condition of the pipe is estimated with the help of a robot that has a camera, temperature sensor, pressure sensor. This data from all the high precision sensors will be transmitted using ZIGBEE protocol from the robot to the control station. The robot incorporates a wireless camera and the data from the camera is transmitted to the front end Visual studio.*

**Keywords:** ZIGBEE protocol; AT89S52 Microcontroller; LM35 Temperature Sensor; L293D motor driver; Pressure sensor ;ADC0804; Keil  $\mu$ Vision IDE ;Embedded C; Visual studio.

### I. INTRODUCTION

Pipe strings are critical components in oil and gas industries. Liquids and gases are transported in pipelines like oil, natural gases, bio-fuels and water. It is a mandatory requirement to maintain crack free pipes to avoid leakages. These cracks may lead to man-made disasters. Bhopal gas incident is one among these disasters. It was considered as the world's worst man-made disaster which took place in 1984. Around 8,000 people died and 57,000 were affected due to the gas leak. In war pipelines are often the target of military attacks. Pipelines conveying flammable materials pose special safety concerns.

The workers dismantle the pipes and it becomes mandatory for them to dig the ground if it is necessary to check the crack. The pipes used in chemical industries are to be maintained at constant temperature and pressure. There are many robots for pipe inspection and generally they are conceived for pipes of industrial applications which have a diameter bigger than 80cm like gas pipelines or hydroelectric power stations. In this article we propose a small robot to explore pipes with a camera to detect breakages, holes, leaks and any kind of defects in pipes.

Due to the variety of pipes that can be found, it is very useful to reconfigure the robot depending on the task being performed. Multi-configurable systems are systems capable of having their modules rearranged. This characteristic makes multi-configurable robotic systems capable of

performing much more types of tasks than conventional systems (non-configurable). These systems can be classified according to the configuration type into manual or automatic, depending on the different number of modules they have into homogenous (only one type of module) and heterogeneous (several types), and according to the configuration, into mobile, lattice or chain. The robotic system described in this paper is manually reconfigurable, heterogeneous and has a chain configuration.

There are a multitude of standards like Bluetooth and Wi-Fi that address medium to high data rates for voice, PC LANs, video etc. However, up till now there hasn't been a wireless network standard that meets the unique needs of sensors and control devices. Sensors and controls don't need high bandwidth but they do need low latency and very low energy consumption for long battery lives and for large device arrays.

Wireless connectivity of a vast number of industrial and home applications has modest transmission data requirements, but demands reliable and secure communication using simple low-cost and low-power radio systems. The IEEE 802.15.4 standard and Zigbee wireless technology are designed to satisfy the market's need for a low-cost, standard-based and flexible wireless network technology, which offers low power consumption, reliability, interoperability and security for control and monitoring applications with low to moderate data rates.

Some of the other conventional detection methods such as magnetic flux leakage and magnetic particle inspection are inadequate for accurately detecting a narrow axial crack. Here the alternating current field measurement (ACFM) technique is used and it is an electromagnetic inspection method capable of detecting and sizing surface breaking cracks in metal specimens [1]. In the sensor network system for non-intrusive and efficient leak detection in long pipelines [2], the system is composed of a set of ultrasonic transducers that are mounted around the pipe in multiple locations. The system combines the transit-time and Doppler based on flow speed measurements in order to deal with various liquid characteristics. The data collected by the individual components are sent over multi-hop routes to base station over radio links for further analysis. Another kind of pressure detection in long distance ore slurry pipeline is done by detection loop pipe, micro-differential pressure transmitter and mercury u-tube difference pressure meter to form the pressure detection [3].

The paper is organized as follows: In Section II we provide a brief description of detection of cracks in the pipe system. The implementation by the sensors is presented in Section III. Section IV discusses the software and hardware details. Finally the results are presented in Section V and we summarize the conclusions in Section VI.

## II. BLOCK DIAGRAM FOR DETECTION OF CRACKS IN GAS PIPES

### A) CLIENT SIDE:

The client side consists of Microcontroller AT89S52, temperature sensor, pressure sensor, ADC, DC motor & motor driver and wireless camera.

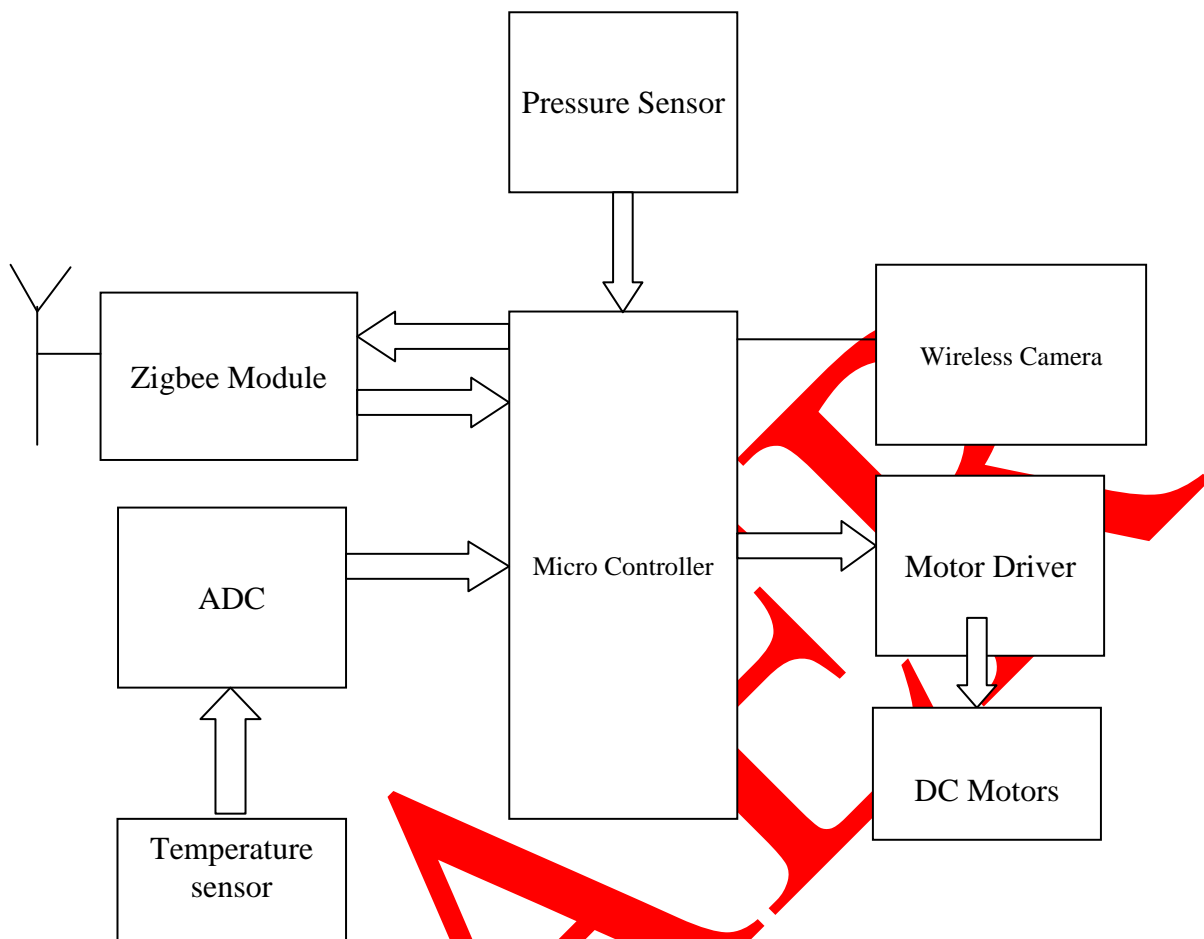


Figure 1. Client side system

IJAER

**B) SERVER SIDE:**

The server side consists of a wireless camera that collects the signal sent by the transmitter, and the receiver collects this signal and outputs it to the computer or TV monitor depending on the type of receiver.

The commands to control the motion of the robot are done with the help of the PC. The software used to interface the robot with the PC is Visual Basic 6.0. To move front, UP arrow key is used, to move back, DOWN arrow key is used and the LEFT and RIGHT arrow keys are used to control the motion of the robot in the left and right directions as shown in Fig.3. The PC is also interfaced to the RF transmitter through the RS232 cable.

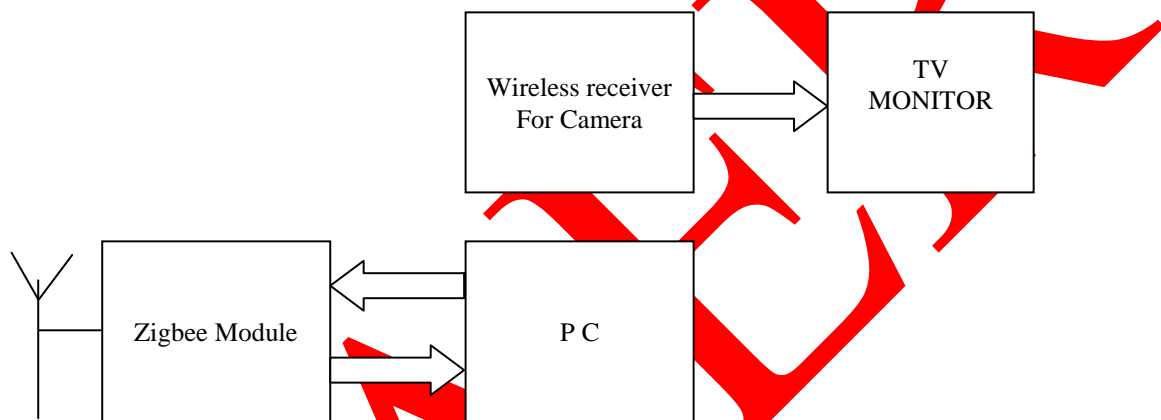
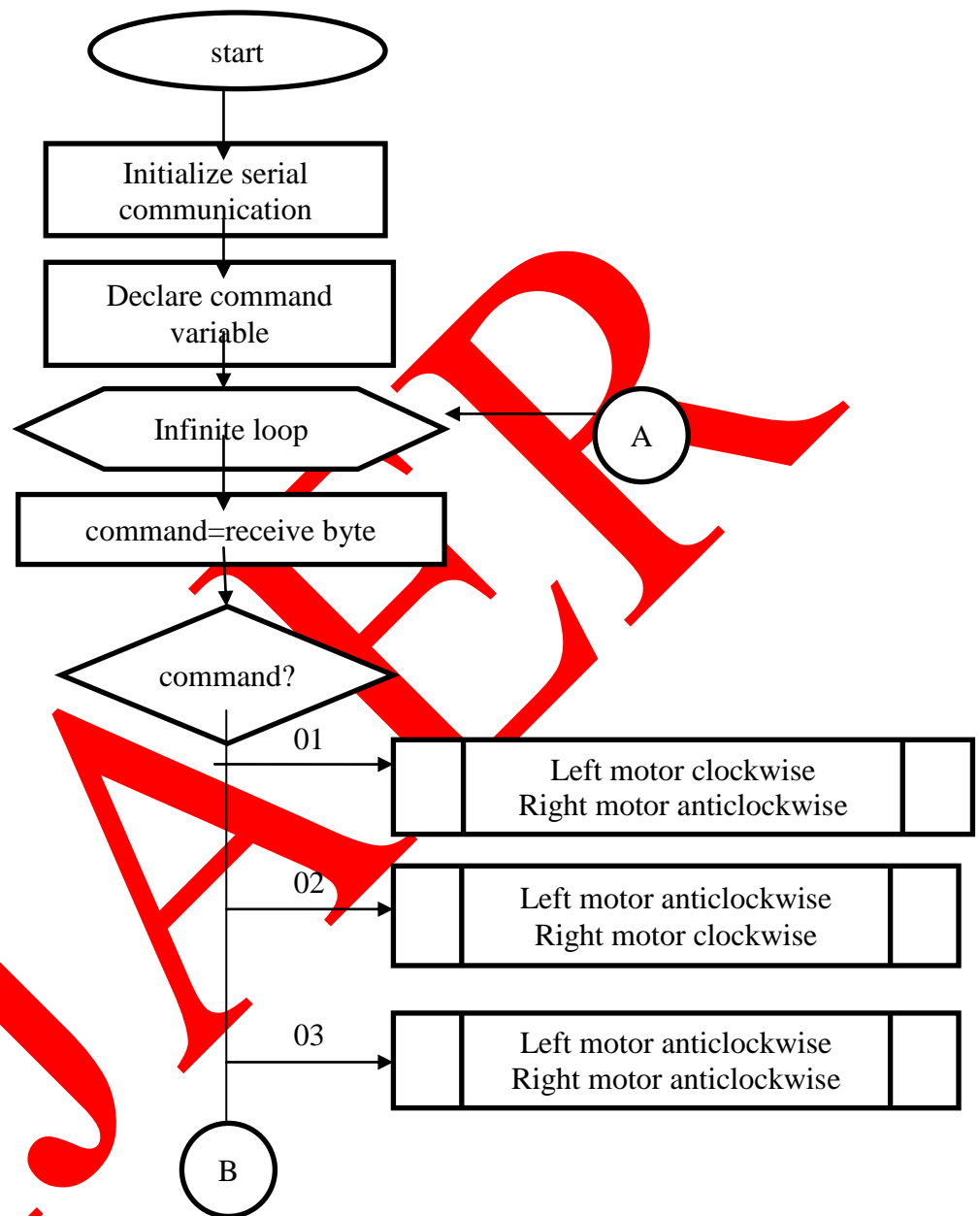


Figure 2. Server side system

Flow chart for robot control



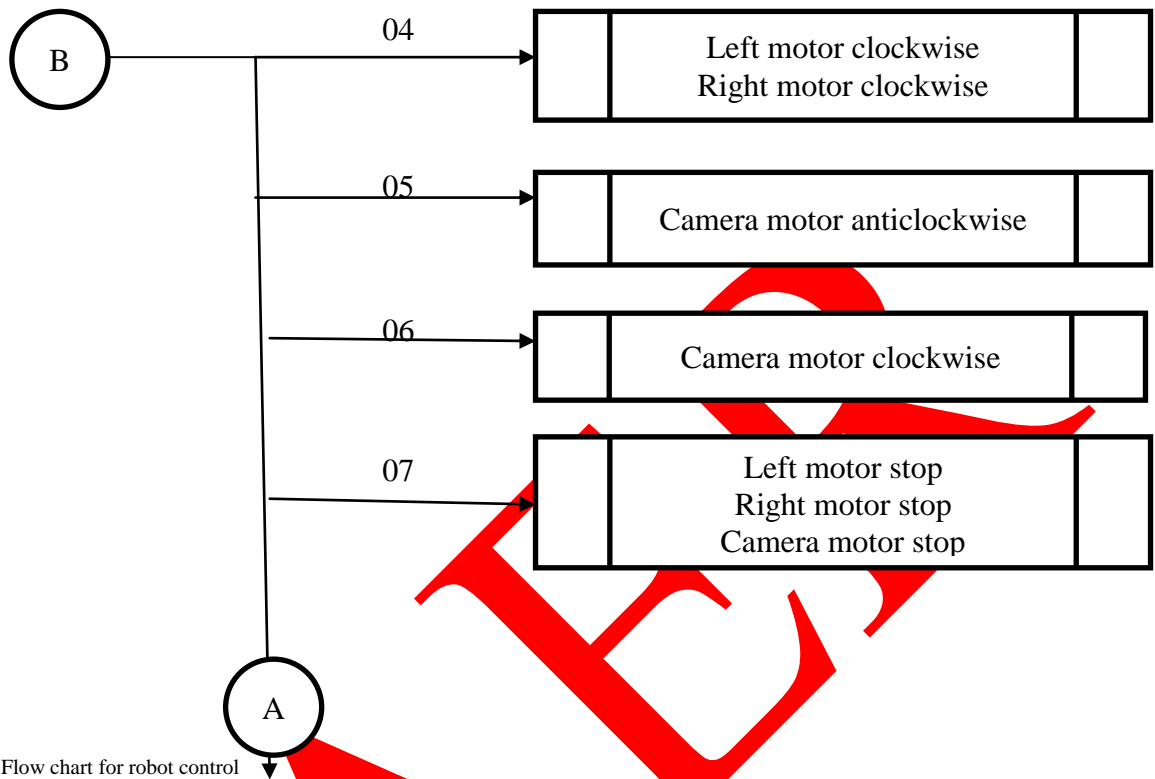


Figure 3. Flow chart for robot control

**IJAER**

**Flowchart for serial communication**

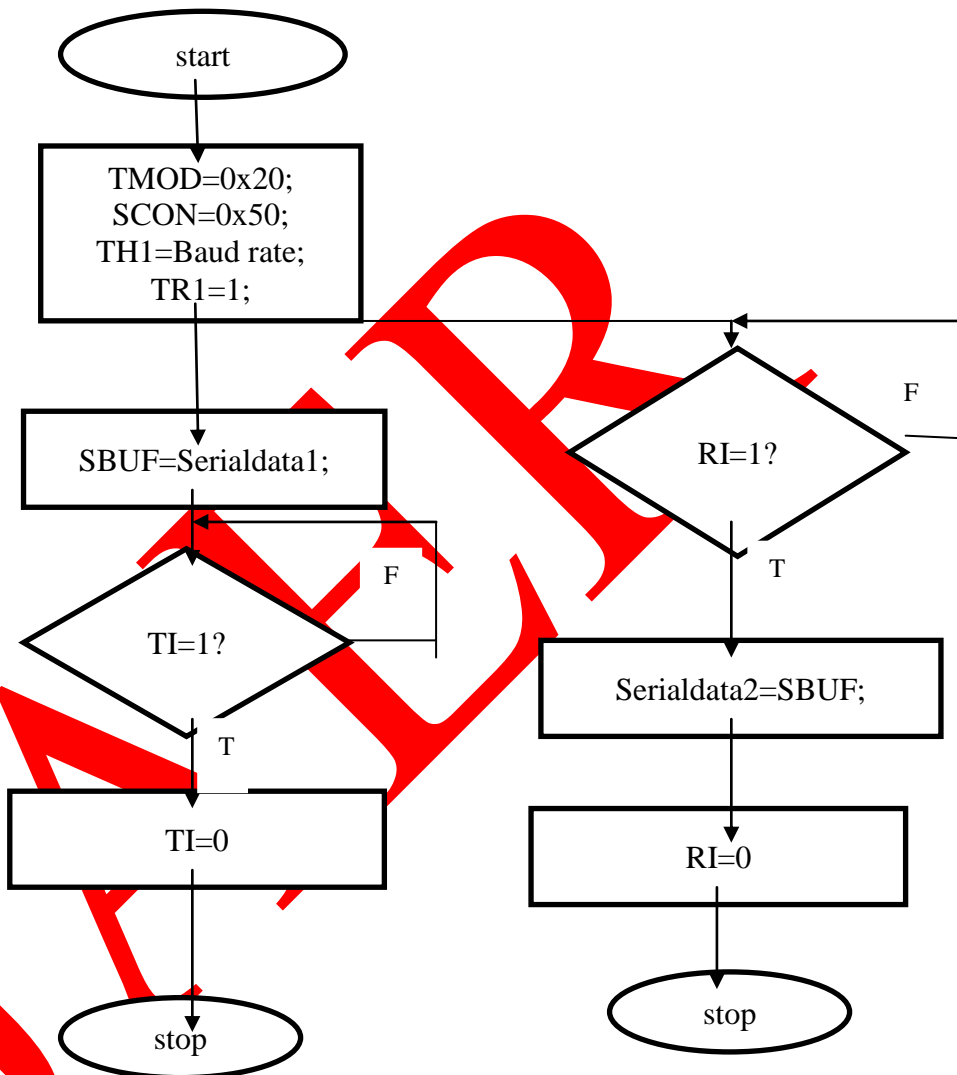


Figure 4. Flow chart for serial communication

**III. IMPLEMENTATION BY SENSORS**

**A) Temperature Sensor**

The LM35 series are precision integrated-circuit temperature sensor whose output voltage is linearly proportional to the Celsius temperature. The LM35 sensor thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 sensor does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room

temperature and  $\pm 0.1^\circ\text{C}$  over a full  $-55$  to  $+150^\circ\text{C}$  temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only  $60\ \mu\text{A}$  from its supply, it has very low self-heating, less than  $0.1^\circ\text{C}$  in still air. The LM35 is rated to operate over a  $-55^\circ$  to  $+150^\circ\text{C}$  temperature range, while the LM35C sensor is rated for a  $-40^\circ$  to  $+110^\circ\text{C}$  range ( $-10^\circ$  with improved accuracy). The LM35 series is available packaged in hermetic TO-46 transistor package.

### ***B) Pressure Sensor***

A semiconductor piezo-resistance dispersion pressure sensor has a semiconductor distortion gauge formed on the surface of the diaphragm, and it converts changes in electrical resistance into an electrical signal by means of the piezo-resistance effect that occurs when the diaphragm is distorted due to an external force (pressure). Pressure sensors can also be used to indirectly measure other variables such as fluid/gas flow, speed, water level, and altitude.

## **IV. IMPLEMENTATION ENVIRONMENT**

### ***A) Hardware description***

- Microcontroller-AT89S52
- DC motor & Motor Driver-L293D
- Temperature sensor-LM35
- Pressure sensor-piezoelectric disc
- Zigbee module
- ADC0804
- Wireless camera

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out.

A DC motor is a mechanically commutated electric motor powered from direct current (DC). The stator is stationary in space by definition and therefore so is its current. The current in the rotor is switched by the commutator to also be stationary in space. This is how the relative angle between the stator and rotor magnetic flux is maintained near 90 degrees, which generates the maximum torque. The motor driver device (L293D) is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays



solenoids, DC and stepping motors) and switching power transistors. A separate supply input is provided for the logic, allowing operation at a lower voltage and internal clamp diodes are included. This device is suitable for use in switching applications at frequencies up to 5 kHz.

Zigbee is a low-cost, low-power, wireless mesh network standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications. Low power-usage allows longer life with smaller batteries. Mesh networking provides high reliability and more extensive range. Zigbee chip vendors typically sell integrated radios and microcontrollers with between 60 KB and 256 KB flash memory.

Wireless cameras are basically described as a wireless transmitter carrying a camera signal. The camera is wired to a wireless transmitter and the signal travels between the camera and the receiver. The receiver has channels to tune in and to get the picture. The wireless camera picture is sent by the transmitter and the receiver collects this signal and outputs it to the computer or TV monitor, depending on the type of receiver.

### ***B) Software description***

- Keil  $\mu$ Vision IDE
- Proload burner
- Embedded C
- Hyper terminal

Keil  $\mu$ Vision is an integrated development environment used to create software to be run on embedded systems. It allows such software to be written both in assembly or C programming languages and for that software to be simulated on a computer before being loaded onto the microcontroller.

ProLoad is software that works as a user friendly interface for programmer board from Sunrom Technologies. Proload gets its name from "Program Loader". It takes in compiled HEX file and loads it to the hardware. Any compiler can be used with it, Assembly or C, as all of them generate compiled HEX files

The embedded C language is a general-purpose programming language that provides code efficiency, elements of structured programming and a rich set of operators. Many applications can be implemented more easily and efficiently with embedded C than with other more specialized languages. The embedded C language on its own is not capable of performing operations that would normally require intervention from the operating system. Instead, these capabilities are provided as a part of standard library. Because these functions are separated from the language itself, embedded C is especially suited for producing code that is portable across wide platforms.

HyperTerminal is a program that can be used to connect to other computers, Telnet sites, bulletin board systems (BBSs), online services, and host computers, using either your modem, a null modem cable or Ethernet connection.

## V. RESULT

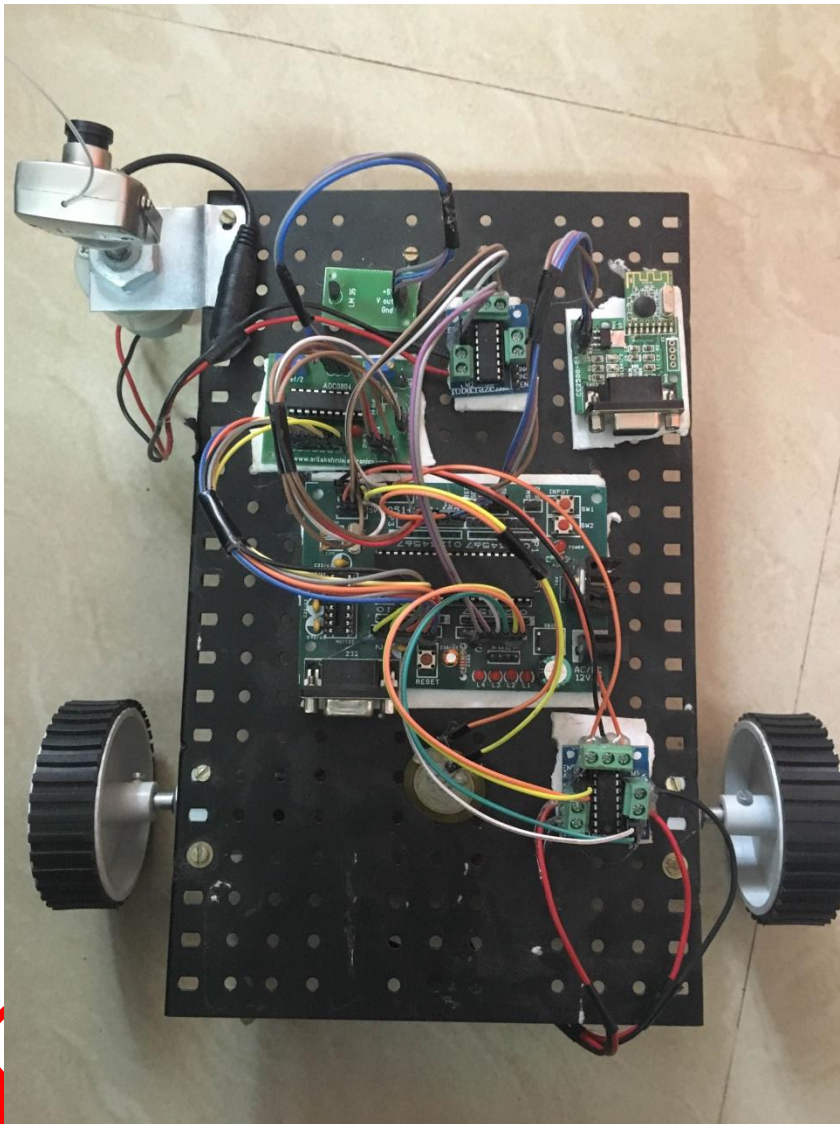


Figure 5. Kroto Finder



- [3] An Jian, Wu Jiande, Pu Gnangyne, Qu cheng zhong, Huang chaobing, Pang chunlei, Liu Hungwei, “A kind of pressure detection method in long distance ore slurry pipeline” , 3rd International symposium on Knowledge Acquisition and Modeling, November 2010.
- [4] Kenneth Ayala , “ The 8051 Microcontroller & Embedded Systems Using Assembly and C”, India edition -2010
- [5] Muhammad Ali Mazidi, “Microcontrollers and Interfacing (For GTU) Pearson Education, 2nd edition– 2012
- [6] [www.alldatasheet.com](http://www.alldatasheet.com)
- [7] Douglas V Hall, “Microprocessors and interfacing-Programming and Hardware” , 2nd edition, McGraw-Hill Education (India) Pvt Limited.

**IJAER**