

# Multipurpose Trash Collecting and Cleaning Robot

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**Abstract**— Now a days, the collecting of waste and empties the bins has become a major problem in urban areas. There are different kinds of waste that affect our environment, for example metallic, plastic, food and Garden waste. Developing waste collecting robotic system is an immense challenge. This kind of robotic based automation is helpful to create smart environment around us. In this paper we mainly focused to collect trashes in autonomous path using robot. This robot is equipped with ultrasonic sensor, PIR sensor, motor control and power unit. The autonomous robots carry out obstacle detection and avoidance, amount of waste in bin.

**Keywords**—waste;ultrasonic sensor;obstacle detection.

## I. INTRODUCTION

The trend of making manually controlled things to automatic has become a common practice these days. The process of making the things automatic is being exploited in almost all the major fields of life. Making things automatic reduces burden on the humans. The cost and effort used in manually controlled products is much higher than the automated systems. Considering the fact, that the problem of efficient waste management is one of the major problems of the modern times, there is an utmost need to address this problem. The proper waste management system is must for the hygienic society in general and for world as a whole. Most of the urban areas and towns in India are not well designed to facilitate the proper garbage disposing and collection mechanism [4]. Also the cities are expanding rapidly putting the pressure on existing infrastructure which is not expanding at the same pace that of urbanization.

A big challenge in the urban cities is Solid waste management. In this paper robots were used to do that work. The robot will track the autonomous path with the help RF ID tag in the path and RF ID reader placed in robot. Robot overcomes the obstacle with the help of PIR and Ultrasonic sensor. In meanwhile, Bin level is observed using ultrasonic sensor. If, the bin gets filled then it moved to the waste segregation area by using Metal sensor.

## II. EXISTING METHOD

In existing method the waste can be collected in the bins. If the waste gets filled it can be identified and send message to the person who is cleaning the waste by the use of GSM. Then the person can come and collect the waste from the bins and dispose in the waste segregation area manually. This method is time consuming and there is also a spillage of wastes around the bins if it is not collected at the particular time. This method also needs a labor to collect the waste from the bin and dispose it in the segregation area. [1]

## III. BLOCK DIAGRAM

### A. Working

This work consists of three modules locomotion, detection, and control unit. The locomotion module is equipped with transporting device and bin to move the robot in autonomous path. The locomotion module movement depends on signals from detection and control unit.

The locomotive consists of Metal sensor, ultrasonic sensor, RF ID Reader, PIR sensor, motor driver and microcontroller. The

metal sensors, PIR sensors and Ultrasonic sensor are attached in front and two sides of the locomotive to overcome the obstacle and make the locomotive to move around its path. The RF ID Reader in the locomotive is used for path navigation. Ultrasonic sensor is used to find bin level. If, the bin is filled it can directly moved to segregation area with the help of metal sensor. The robot direction and all sensors input are processed by EK-TM4C123GXL low power microcontroller.

The TIVA C series TM4C123GXL family of ultra-low-power microcontrollers consists of several devices featuring different sets of peripherals targeted for various applications. The architecture, combined with five low-power modes, is optimized to achieve extended battery life.

### B. Block Diagram

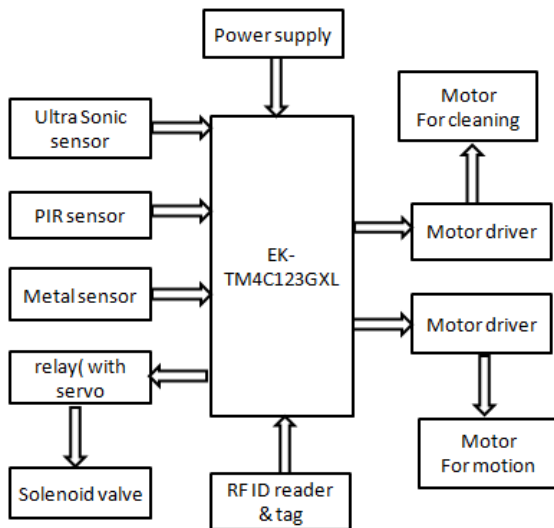


Fig.1 Block Diagram

## IV. HARDWARE

### A. EK-TM4C123GXL

The TIVA™ C series TM4C123GXL Launch Pad evaluation board is a low cost platform ARM Cortex. [10] It is a M4F based microcontrollers. It has a USB 2.0 interface and programmable user button. This Launch Pad makes an interface easy and simple to expand the functionality. It also contains many input and output pins. This Launch Pad is mainly used for its easy interfacing and functionality. TM4C123GXL have following features

- Operates at 80 MHz, contain 32-bit ARM Cortex-M4-based microcontroller CPU
- It contain 256KB Flash,32KB SRAM,2KB EEPROM as Memory
- USB 2.0 interface

- 2 controller area network modules
- 8 UART,6 I2C,4 SPI
- RGB LED for custom applications

### B. RFID Reader and TAG

It is used for identification and tracking purposes. This uses radio frequency identification device RFID tagging system consists of the tag, a read/write, or only read device and a system application for data collection, processing and transmission. It was two parts integrated circuit and an antenna for receiving and transmitting the signal. The non-volatile memory is used to store tag information. Power source in RFID are referred as active tags.

### C. Ultrasonic Sensor

Distance measurements are done by using Ultrasonic sensor. That measure distance between moving or stationary object. Triggering an ultrasonic burst is done by single I/O pin and return pulse is an “echo”. The value is measured from the microcontroller by the way of meaning the time required for echo return. Provide measurement within 2cm to 3m range. It can work at any lighting condition this makes good supplement for infrared object detectors. Ultrasonic sensor utilizes the properties of sound. The output may be switching, analog or both based on application.

### D. DC Motor

It is a class of rotary electrical machines that is used to convert electrical power into mechanical power. All types have same internal mechanism, to periodically change the direction of current flow. The speed of the dc motor can be controlled by variable supply voltage or by changing the strength of current in its field windings. It is a lightweight motor. They are used in portable power tools and application.

### E. Servo Motor

It is a rotary actuator or linear actuator .Servo motor is used for controlling angular or linear position velocity and acceleration for position feedback .It contains motor coupled to a sensor. It has high efficiency and high power. Servo motor is used in closed loop control system.

## V. SOFTWARE

### A. Energia

It is a community driven integrated development environment. It is an open source and software framework. It is easy to use because it provides intuitive coding environment as well as robust framework. It contains functional APIs and libraries for programming a micro controller. It also supports many TI processors that are available in the launch pad development eco system. Energia is an IDE that is used to program TM4C123GXL.

Energia is an open source. It is easy and simple to use. Energia support for various TI embedded devices like MSP430, TM4C, CC2300, C2000, etc. It also contain build-in serial monitor. It contains high level libraries.

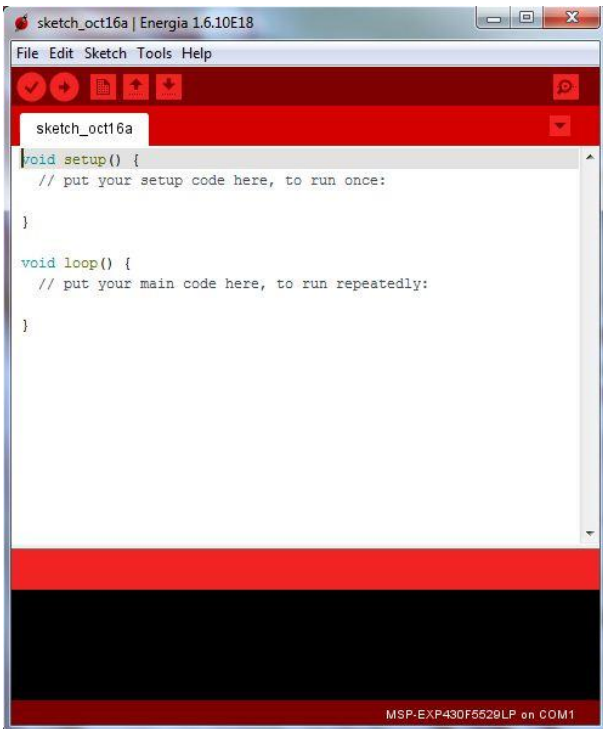


Fig.2. Energia IDE

## VI. RESULT AND DISCUSSION

The design for our robot is shown in the figure it moves in the autonomous path to collect waste and dispose waste in segregation area with the help of ultrasonic sensor, metal sensor, PIR sensor, RF ID after detecting the level of the bin in the robot. Once the bin in the robot filled then only the robot can move to the segregation area until then it collect the waste in the autonomous path. In addition to this it also collects the waste in the autonomous path by using the brush at the front side of the robot. These wastes are collected at the waste bin fitted at the bottom of the robot. It can also clean the floor by using the cleaning mob attached at the back side of the robot.



Fig.3. Design of Multipurpose trash collecting and cleaning robot

## VII. CONCLUSION

The multipurpose trash collecting and cleaning robot have a wide range of industrial and residential applications such as collecting the waste and disposing it in the waste segregation area. In addition to this ,it also cleans and collects the waste in the autonomous path. Robots can be designed to reduce human work and time consumption. DC motor controlled by using EK-TM4C123GXL.It is capable of moving forward and backward. Ultrasonic sensor is attached at the front of the robot. The robot can stop automatically when the obstacle is detected in its path. Robot can move after the obstacle is detached from the path. RF ID connected at the robot is designed to move around the autonomous area to collect waste. The implemented design can detect level of bin in robot by using ultrasonic sensor. It can automatically move to the segregation area by the help of metal sensor. It collects the waste at the autonomous path by using cleaning brush. It also cleans the floor by the use of cleaning mob.

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