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A real-time autonomous waste-collecting robot

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ABSTRACT

Now-a-days, Collecting and segregating of waste has become one of the greatest challenging and arduous chore for municipal corporations, all around the globe. To make this tedious job facile, a new concept of autonomous waste collecting robot has been taken into consideration for Smart buildings, hospitals, schools and railway stations. The autonomous waste collector thought is an advancement of traditional waste collector by levitating it to become smart inculcating sensors and some form of logics. This autonomous collector is a revolutionary idea of application of line following and pick and place robot .IR sensor makes the use of line following robot, ultrasonic sensor make the use to detect the waste, DC motors are used to collect the waste and RF ID used to make location of the waste to the robot. The advantage of this project is the ability of the robot to separate metallic and non-metallic waste by using metal detector. This is thereby a fully automated system, making small contribution towards the theme of Clean India Green India.

Keywords— *Waste Collecting Robot, IR Sensor, Ultrasonic Sensor, Metal detector, Arduino, RF ID, DC Motors*

1. INTRODUCTION

Robots are not made as simple machines, they are several steps ahead of a typical machine. It will perform totally different robust jobs. However, the advancement is that they can adapt with their own. Once programmed robots will perform needed tasks repeatedly in identical means. Robots play important role in repetitive jobs that are boring, stressful, or labor-intensive for humans. Robots are progressively marching into our daily life activities.

At present, over 20 million household robots, and a further 2.7 million industrial robots, are operating worldwide. There is a misconception with people that robot and automation eliminate manufacturing jobs but actually they create more desirable jobs, like engineering, management, programming, and equipment maintenance and also free up manpower critical constraints to let companies maximize workers skills in other areas like business. The humanoid robot with wheels which can perform skillful tasks using both arms with end effectors could be treated as one of the ultimate robots, with applications not only on earth but also in space.

Computer Programming which makes the robot to be smart enough by the combination of the robot environment information and the end user. Electronics - allows the control system to drive all motors and get environment condition from sensors. The environmental robot we worked on is an "autonomous waste collecting robot", which will do tedious and repetitive tasks at high cycle rates and speed.

Here we use sensors like Infrared Sensor (IR), Ultrasonic Sensor, Metal Detector, Arduino, RF ID, DC motors.

2. LITERATURE SURVEY

In this work, "Autonomous Garbage Collector Robot" has been designed for consumer/office environments. This robot operates in autonomous mode as well as in manual mode along with additional features like scheduling for specific time and bagless dirt container with auto-dirt disposal mechanism. This model consists of a metallic roller in front of it fixed to continuously roll and collect all the wastes on its path [1].

In this pick and place robot, ultrasonic sensors have been used up to avoid the obstacle and detection and also pick and place the goods in a specific place. There will be no need of remote to control the vehicles, because it is purely depend on the internal coding and that is already set up in the robot, to detect obstacle and to avoid it in the moving path. In case of any obstacle is found on the path then the ultrasonic sensors will detect the obstacle and therefore the detected obstacle will be flowed off or pick and place on one side. If obstacle is on the side of the robot then the speed of the robot is increased and it will travel quick in that path before the obstacle hit the robot. This helps to detect obstacle and can easily safeguard the robot [2].

The operation of micro robotic system, microsphere were picked and placed to form patterns, then the system starts with the contact detection to determine the depth position of the gripping arms relative to the substrate surface. The pick-and-place operation gets started when the micro-gripper was then moved upward by 15μm above the substrate. The micro robotic system means "looking-and-moving" system. Transformation between the image frame (x–y) and the micro robot frame (X–Y) was achieved with calibrated pixel sizes [3].

CLEAR (cleaning entresol autonomous robot), which is named by its variable speed and power efficient. It is used to make a vacuum cleaning which is either fully autonomous or manually featured with user friendly interface. This robot is used for cleaning, brushing, and auto-disposal of wastes. CLEAR is used in autonomous and manual modes according to the user. In the autonomous mode, the robot is set with proper date and time, where as in manual mode, the robot is used up to save energy and similarly to clean the particular place [4].

The line follower is autonomous robot which identifies the line and follows it. The path might be visible like a black line on a white surface or vice-versa or it can be invisible like a magnetic field. A close loop control system is used over here. The robot must sense a line and it stands accordingly in the course whereas, the wrong moves can be corrected by using feedback mechanism thus forms an effective closed loop System. The robot is designed to follow very tight curves respective to the similar as of the data from the sensors which are continuous in nature. This robot is simple and also possesses effective straightforward design to perform line following task [5].

Smart Garbage Collecting Robot and Monitoring System, height of the trash that is filled in the fixed part of bin is done by using an Ultrasonic sensor and thus the level is remitted to the garbage car part. Thus, the remission part is done with the help of RF Module. Microcontroller is mainly use to interface the ultrasonic sensor with the RF module. This is a fully automated system in which the garbage car moves automatically when it gets a signal that is raised from the Garbage bin when it is filled, through the RF Module [6].

3. EXISTING SYSTEM

The present tried and tested methods of garbage collection have so far been proven ineffective. And the world today is looking at smarter ways of overcoming the garbage collection problem. This paper presents the Garbage Collector robot for foot path using Arduino microcontroller. The robot is built on a metallic base of size 50x40 cm which is powered by battery of 12V, 7.5Ah. The robot movement is controlled by programming the Arduino. The robot is designed to collect Garbage at foot path, public places (parks, schools and colleges), mostly cemented paths and beach. The robot cannot be used on muddy surfaces. The robot is built in such a way that, when it is started it will move on the path defined in the program. When it encounters the obstacle, depending on the conditions applied in the program the robot proceeds with further motion and then robot picks up the garbage.

4. PROPOSED SYSTEM

So, there were the several problems which need to be worked upon in former system. This can be done by creating a new system which is Automated, Energy conserving and cheap. Our system is designed in such a manner that it could identify metals and non-metals. Initially a line follower robot is constructed. This line following robot moves on the line that is drawn on the surfaces wherever the waste collection is to be done. It moves according to the command given by the Arduino in which the line following coding is dumped. Two IR sensors are placed in the front side of the robot, which absorbs the IR radiation from the black coloured lines that is drawn down. In addition to this setup we have added mechanical gripper which is similar to the robotic hands. These grippers are used to bring a cost-efficient system rather doing it with robotic hands which is not cost efficient. This is off course a mechanical setup used to pick up the dust particles on the path where the robot moves. This gripper and mechanical hand structure is worked according to the embedded c coding dumped in the Arduino. The main advantage of this system is it is constructed in such a way that it could identify and differentiate the metallic and non-metallic wastes. This is done by using the metal detectors.

4.1 Components of the proposed system

4.1.1 Hardware module

- Arduino
- Ultrasonic sensor
- Infrared sensor
- Metallic sensor
- L293D
- Robot setup

4.1.2 Software module

- Embedded C

5. BLOCK DIAGRAM

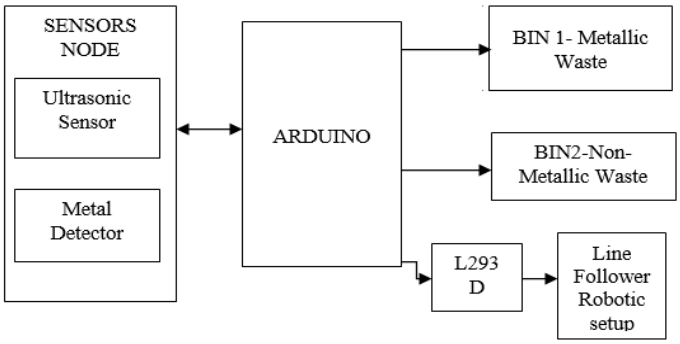

Fig. 1: Block Diagram

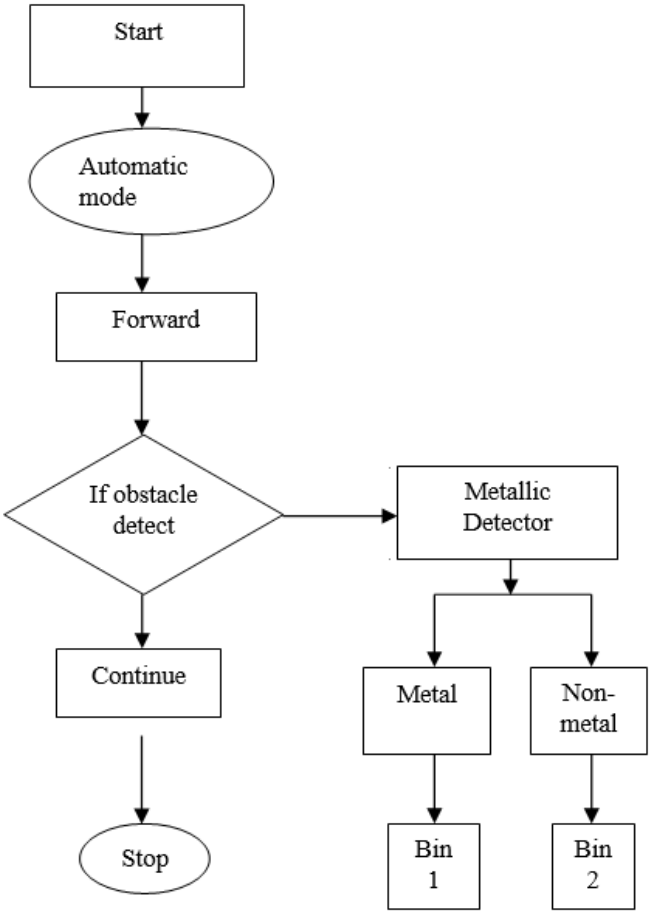

Fig. 2: Flow Chart

The ultrasonic sensor is used to find out whether there is any obstacle in the path or not. This is done by the sound waves

produced from the sensor. The wave from the transmitter to the target is measured to calculate the distance from our robot to that object. A metal detector is a portable electronic instrument which detects the presence of metal nearby, if any metal is detected then it placed in bin1 and non-metal particles are placed in bin 2. L293D is a Motor driver integrated circuit which is used to drive DC motors rotating in either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. The L293D is a Dual Full Bridge driver that can drive up to 1Amp per bridge with supply voltage up to 24V. It can drive two DC motors, relays, solenoids, etc. Two H bridges of L293D can be connected in parallel to increase its current capacity to 2 Amp.

6. CONCLUSION

The robot first starts moving on its line, once if there is any obstacle identified on its path it stops. Here we use the ultrasonic sensors to identify the obstacles. Then the robot is ready to pick up the waste. If the robotic arm is not exactly on a correct position to pick the waste, it is moved accordingly using the RFID tags. There are four tags having commands such as move right, left, up and down. Once the gripper is moved down near to the waste the metal detector works and it is identified whether it is a metallic or a non-metallic waste. Finally, if the waste is metallic it is placed in the first dustbin placed on the backside of the robot and if it non-metallic waste it is placed in the second dustbin.

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