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REVOLUTIONIZING FLOOR CLEANING: DESIGN AND DEVELOPMENT OF A SMART SOLAR-POWERED FLOOR CLEANING MACHINE

DR.J. ASHOK[1], M. PAVITHRA[2], T. PERIYANAYAKI[3], C. MIDHUNA[4]
1 ASSOCIATE PROFESSOR, 2,3,4 UG STUDENT
ELECTRONICS AND COMMUNICATION ENGINEERING
V.S.B. ENGINEERING COLLEGE, KARUR, TAMILNADU, INDIA

ABSTRACT

Automatic floor cleaner is a compact robotics system which provides floor cleaning service in room and big offices reducing human labor. Basically as a robot it eliminates human error and provide cleaning activity with much more efficiency. If we clean the floor manually then there is a possibility that the operator will leave some portion of the floor. Also due to manual labor involved this is time consuming and irritating to clean the floor. Also in big offices floor area is very huge and the people involved there for cleaning purpose cannot clean it much more efficiently. This is where the robot comes as an advantage. Also the robot is small and compact in size. So we can carry it and place it wherever we can on the house. Also in industries the robot is very cost effective as compared to manual labor involved. The flexibility, time saving and efficiency make the robot a clean choice for cleaning the floor. The complete ground cleansing robotic is split into numerous parts, particularly together with an PIC16F877A microcontroller, proximity sensor and Dc Motor with IR sensor, Motor Shield L298. This device works whilst the pic16f877a microcontroller strategies the proximity sensor as a distance detector and a DC motor as a robotic driver, then the DC motor is pushed through the Motor Shield L298. When an IR sensor detects a barrier in the front of it, the robotic will robotically turn on the buzzer. The distance fee at the sensor has been determined, that is, whilst the distance study through the proximity sensor is under 15 cm. The consequences of trying out the fee of the ultrasonic sensor distance located unique situations that occur. In a distance of> 15 cm, the circumstance of the prototype cleansing robotic for the street ground cleansing is obtained, at the same time as the distance.

Keywords: Solar Panel, Micro Controller and sensors.

1. INTRODUCTION

Cleaning is Important work approximate every place. Sometimes this is easy and sometimes difficult. Sometimes we assigned people for purpose of cleaning and pay money and sometimes cleaning is required in areas where presence of living being dangerous so we cannot have assigned living being in every place. Some places are so that have a large floor area in that place for cleaning purpose we need more than one person so we required some technique to compensate these problems. In advancement of science a robot come in light but it operates by some personnel. To avoid this limitation of personnel we require more technologies. Automation is a great solution of this problem. So we make an autonomous floor cleaning robot that operated by internet of things and pic microcontroller programming. IR sensor is the most important component for autonomous floor cleaning robot because IR sensor works as eyes of robot. IR sensor useful to sense the obstacle or wall. Sensing distance range of robot set by proximity sensor. In this range robot sense,

the obstacle and turn back. Households of today are becoming smarter and also more automated. Home automation delivers convenience and creates more time for people. Domestic robots are entering the homes and people's daily lives, but it is yet a relatively new and immature market. However, a growth is predicted and adoption of domestic robots is evolving. Several robotic vacuum cleaners are available on market but only few ones implement wet cleaning of floors. Purpose of this project is design and implement a Vacuum Robot Autonomous and Manual via Phone Application named as cayenne. Vacuum Cleaner Robot is designed to make cleaning process become easier rather than by using manual vacuum. The main objective of this project is to design and implement a vacuum robot prototype by using pic16f877a, IOT, motor driver IR Sensor and to achieve the goal of this project. Vacuum Robot will have several criteria that are user-friendly

2. OBJECTIVES

To clean the designated area quickly and efficiently, ensuring that all dirt and debris are removed.

To make cleaning tasks easier and more convenient for humans by handling the repetitive and time-consuming tasks.

To reach and clean difficult-to-reach areas that might be challenging for humans to access.

To improve the overall hygiene and cleanliness of a space, reducing the risk of disease transmission and promoting a healthier environment.

To minimize the energy consumption and environmental impact of cleaning tasks, utilizing resources in an efficient and sustainable manner.

To be easy to operate and manage by users, ensuring that the cleaning robot can be utilized to its full potential.

To ensure that the cleaning robot operates safely, minimizing the risk of accidents and injury to humans and property.

3. LITERATURE SURVEY

Adeel Saleem; Atif Iqbal "Design and Implementation of an Intelligent Dust Cleaner Robot for Uneven and Nonstruc-IEEE

This existing system represents the room cleaning robot which has map storage and wall following functionality and all this implemented using Arduino Uno. With the combination of sensor assembly, algorithm and the intelligent dust cleaner shape make him feasible and effective for all type of environments. It has much more benefits over conventional household vacuum cleaners such as there is no need of personal to clean the room, office etc. and fulfilling the main purpose for cleaning the room automatically

R. Gopalakrishnan "Design and Development of Controller Based Automatic Ground Cleaning Robot"IEEE

They have developed a primary goal of this assignment is to plan and execute an Automatic Floor Cleaning Robot using Arduino UNO, Bluetooth module, Power semiconductors, Motor ShieldL293D, Water pump, Servomotor, and to achieve the goal of this enterprise. This project will include few client-friendly initiatives. This paper coordinates the advancement of a cleaner programmable platform. Currently, a significant emphasis is placed on the field of mechanical technology in order to reduce human endeavours. The primary goal of this research work is to develop a cleaner that is totally programmed to do dry and wet cleaning as well as UV cleansing.

Teng Li; Dongchao Yang "A Mobile Robot Design for Efficient and Large-Scale Solar Panel Cleaning" IEEE

They have developed a cleaning robots can be classified into three categories, the on-board mobile robot, the wall-mounted cleaning robots, and vehicle-mounted mobile cleaning robots. Regarding large scale photovoltaic panel cleaning, a cleaning robot must be equipped with agile ability to move across panels to clean photovoltaic panels of different arrays. On-board mobile robots and wall-mounted cleaning robots have

insufficient ability to move across panels of different arrays. Although traditional vehicle-mounted cleaning robots have the ability of panel-crossing, the use of internal combustion engines will cause pollution and require manual fueling. In this paper, we propose a fully electric-driven mobile cleaning robot design with autonomous navigation ability capable of working at large-scale photovoltaic power plants.

Ashish Mohan; Ajay R Krish Design and Simulation of an Autonomous Floor Cleaning Robot with Optional UV Sterilization-IEEE

The robot uses ball and standard wheels for locomotion. The main computer on board will be an Arduino micro controller. The 3D design of the robot is made using solid works software and the stimulation of the robot being done on ROS 2 software platform. The path planning and simultaneous localization and mapping (SLAM) will be done on ROS2 using the ROS2nav2 platform. The path planning algorithm being Dijkstra's, Behaviour tree (BT)algorithm as it achieves more accurate path planning with shortest time and obstacle avoidance algorithm is also included. The visualization of the robot is achieved using Rviz visualization tool.

Gregorius Gery Gavindra; Hendra Kusuma "Vacuum Cleaner Robot with Staircase Cleaning Feature and Boustrophedon Path Planning"-IEEE

The robot is tested by placing it at 4 different initial position, repeated 10 times for each to test its ability to find the nearest corner, and then, using the same arena, make the robot cover it completely using boustrophedon path planning. This results in 100% success rate in finding the nearest corner and 85% success rate for complete area coverage. Vacuum cleaning ability is then tested by having the robot clean traces of flour and salt, representing very fine and small particles of dirt, but due to a bad design for the dust collection tunnel, the vacuum suction power is very weak and this results in failure to completely clean both substances.

4. SYSTEM DESIGN

4.1 EXISTING SYSTEM

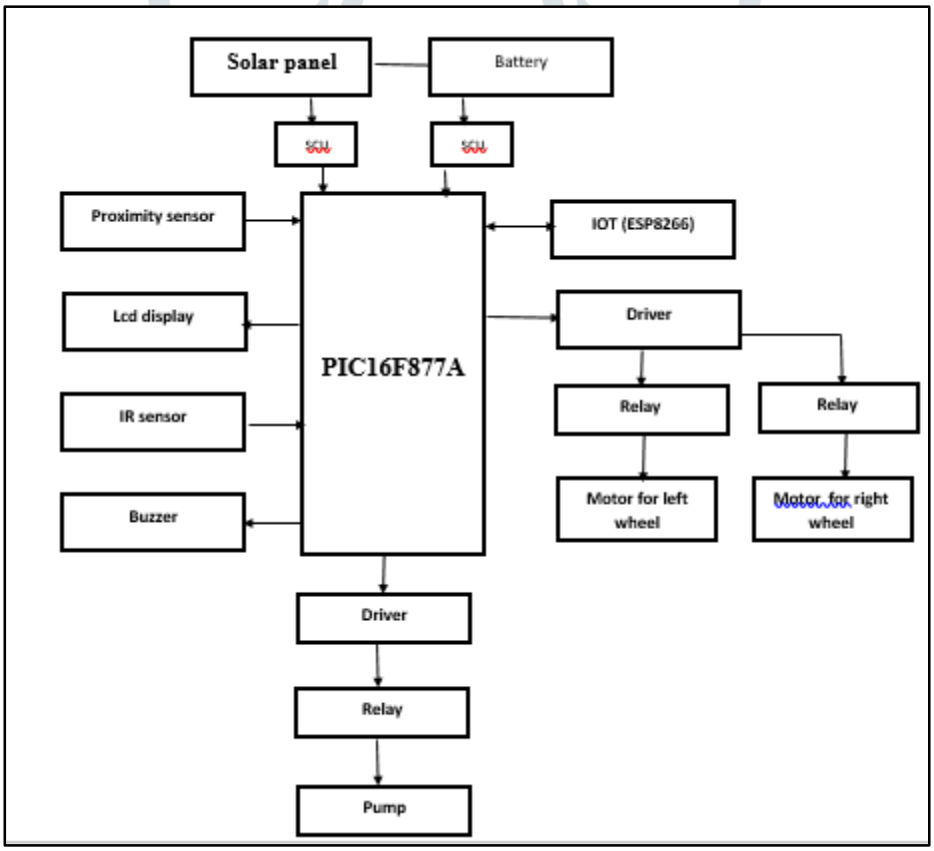
The control architecture of PR-I is including upper application layer and bottom control layer The upper application layer provides a man-machine interface, which can obtain information and send control instructions. Robot status, sensor data, and images are displayed on the operation interface and mobile monitoring terminal. The operator can use the handle to control the robot movement manually. The bottom control layer is an embedded system based on ARM microcontroller, which realizes hardware drive and control algorithm programming. The master-slave control mode is adopted, and the master controller is responsible for sensor data acquisition and processing, communication, and motion planning. The slave controller is responsible for driving the actuator, and the control form is position and speed control. The remote operation terminal communicates with the robot embedded system by establishing a local area network, and the optical ber is used as the signal transmission medium. Client-server mode is adopted. The microcontrollers and camera module in the bottom control layer are used as the servers, and the upper application layer is used as the client. At the operation terminal, different devices (operation interface, handle or mobile devices) can be connected to different server addresses (controller or camera) to get the required data.

4.2 PROPOSED SYSTEM

Today Robots are excessively used in every field namely household, hotels, offices etc. Due to growing demand for automation, we are proposing an automatic and manual IOT based vacuum cleaning robot. In the market, various robots are available but their high price and low versatility are the main cons that hold back selling rates. The aim in implementation of this model is to build a cost efficient, low maintenance, and user-friendly robot that can perform dry vacuum cleaning. It operates on two modes namely automatic and manual. This vacuum cleaning robot is capable of sucking the dust, obstacle detection and scheduling the cleaning work through android application. This robot will help handicapped people to clean their house without any external help. Pic16f877a and node MCU control all software and hardware operation of the vacuum cleaner robot. Solar panel battery charging is a process of converting sunlight into electrical energy that can be stored in a battery for later use. This process involves the use of a solar panel, a charge controller,

and a battery. The solar panel is made up of photovoltaic cells that convert sunlight into direct current (DC) electricity. The charge controller is used to regulate the amount of current flowing from the solar panel to the battery, preventing overcharging or undercharging of the battery. The battery is used to store the electrical energy generated by the solar panel. The robot would be powered by a solar panel power system, which would allow it to operate without being connected to an external power source. The robot would use proximity sensors to detect obstacles in its path and navigate around them. This would ensure that the robot is able to move through the cleaning area without colliding with any objects or people.IR (infrared) sensors can be used to detect obstacles. IR sensors work by emitting infrared radiation and detecting the reflection or absorption of the radiation by nearby objects. When an object is detected, the sensor can trigger a response, to alerting a user of the presence of an obstacle. Cleaning Mechanism: The robot would be equipped with a cleaning mechanism, such as a brush or suction device, to remove dirt and debris from the surface. The cleaning mechanism would be activated automatically when the IR sensors detect dirt or debris on the surface. IoT module: An IoT module, such as a Wi-Fi or cellular module, could be integrated into the cleaning robot to allow it to connect to the internet and communicate with other devices. This would enable remote monitoring and control of the robot, as well as data sharing and analysis. Cloud platform: A cloud platform could be used to collect and store data from the cleaning robot, such as cleaning history, and controlling the robot. This data could be analyzed to provide insights into the robot's performance and identify areas for improvement. Mobile app: A mobile app could be developed to provide users with a user-friendly interface for controlling and monitoring the cleaning robot. The app could allow users to schedule cleaning times, adjust cleaning modes, and receive notifications when the robot needs maintenance.

5. BLOCK DIAGRAM



6. HARDWARE DESCRIPTION

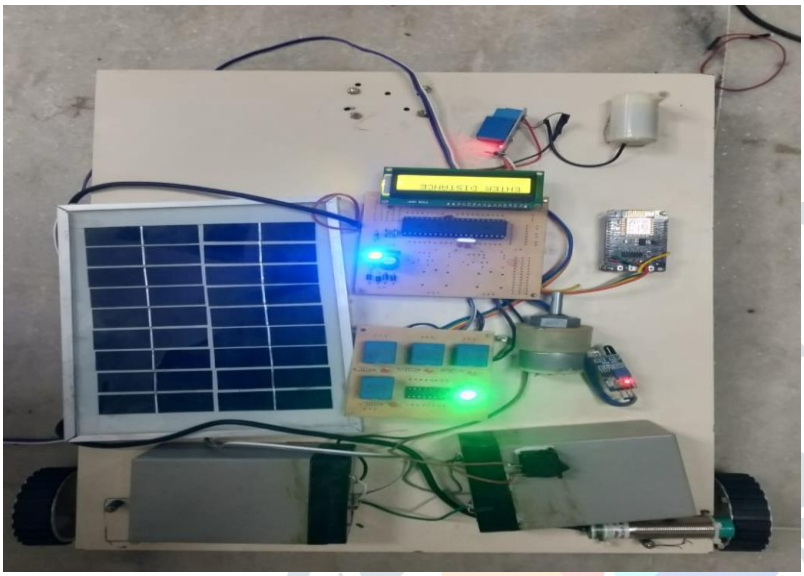
Battery Cells
Lead Acid Battery
Pic Microcontroller
Lcd Display
Ir Sensor
Buzzer

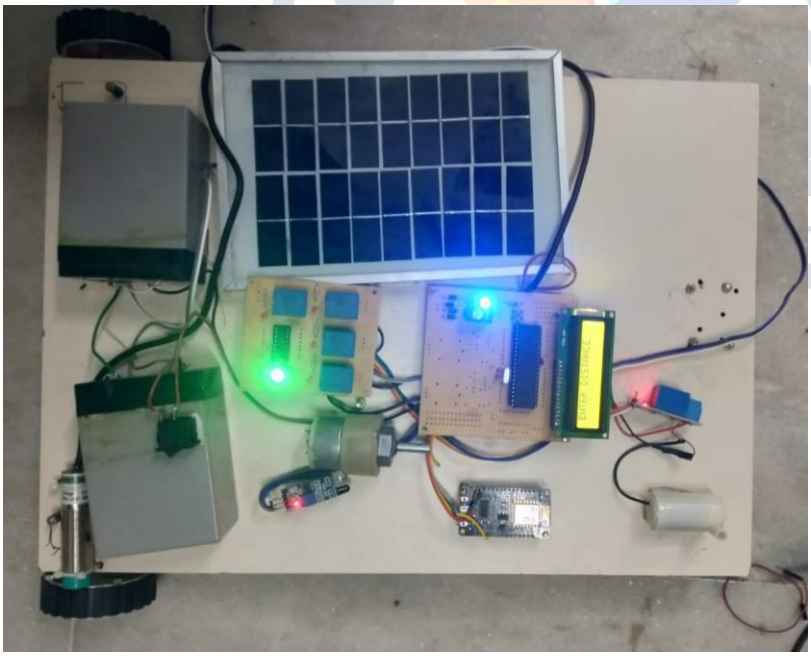
Relays
Solar Panel
Dc Motor

7. SOFTWARE DESCRIPTION

MPLAB IDE Software

8. EXPERIMENTAL SETUP





9. RESULT AND DISCUSSION

Automatic floor cleaner robots are an efficient and cost-effective solution for floor cleaning, especially in large areas such as big offices and industries. These robots eliminate the possibility of human error and provide a thorough cleaning, saving time and effort. The components of the robot include a microcontroller, proximity sensor, DC motor with IR sensor, and Motor Shield L298. The robot operates by using the proximity sensor as a distance detector and the DC motor as a driver, which is controlled by the microcontroller. When an IR sensor detects a barrier, the robot will turn on the buzzer. The distance value at

the sensor is monitored, and when it is below 15cm, the robot starts cleaning. These systems providing useful solution while making the floor cleaning mechanism by using robot. The cost of the system is less and it gives the reliable output as compared to another system which useful for society. To have safe and It is mainly implemented on a long scale for the better results and problem free solutions in the future.

10. CONCLUSION

Automation plays the major role in our daily life, since automation reduces the labour work, time and cost etc. Many automation processes in industry, hospitals and offices can be done with the help of robotics. Automating cleaning operation is one of the important process which is needed to be concentrated. This project enlightens about the advancement in cleaning. Ingenious floor cleaner robot with vision operates in two modes according to the user's wish. This mopping operation can be selected by a switch in automatic mode and in human control mode it is done through the application. This robot efficiently cleans the area.

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