**LAWN GENIE - Lawn maintenance tool.**

**Capstone Project Proposal**

**Submitted by:**

(102016081) ABHAY BEDI

(102016096) ABHAV GOEL

(102016091) APARNA SOOD

(102016097) PRATHAM MITTAL

(102017118) SUVANSH SHARMA

**BE Third Year- COE/ CSE**

**CPG No. \_\_\_\_\_**

Under the Mentorship of

Dr. Neeraj Kumar

Designation: Professor



**Computer Science and Engineering Department**

**Thapar Institute of Engineering and Technology, Patiala**

**MONTH & YEAR**

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**Mentor Consent Form**

I hereby agree to be the mentor of the following Capstone Project Team

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| **Project Title:** | | |
| **Roll No** | **Name** | **Signatures** |
| 102016081 | Abhay Bedi | C:\Users\bedia\AppData\Local\Microsoft\Windows\INetCache\Content.Word\d7495464acc16ca7d29f98157887833a.png |
| 102016096 | Abhav Goel |  |
| 102016091 | Aparna Sood |  |
| 102016097 | Pratham Mittal |  |
| 102017118 | Suvansh Sharma |  |

NAME of Mentor: Dr. Neeraj Kumar

SIGNATURE of Mentor: . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

**Project Overview**

The proliferation of advanced technology has significantly improved and streamlined our work processes. There has been a surge in the usage of self-sufficient systems and gadgets in our daily routines. The substantial rise in fuel expenses and the harmful impact of toxic gas emissions from fuel combustion on the environment are driving the adoption of renewable solar energy as a primary energy source.

The objective of this project is to design a cutting-edge, automated lawn mowing system that outperforms existing models. Unlike traditional lawn mowers, this grass cutter is powered by clean and renewable energy sources, such as solar energy. This new design not only reduces air pollution but also offers an improvement over existing models.

Our system aims to make lawn maintenance easier and more efficient while reducing environmental impact and noise pollution. This innovative and environmentally friendly alternative is a greener choice compared to conventional gas-powered lawn mowers. With this system, consumers can play a positive role in protecting the environment while also enjoying a simpler and easier lifestyle.

**Problem Statement**

Conventional lawn mowers have several problems, including environmental impact from air and soil pollution, noise pollution, safety concerns, costly maintenance and repair, high initial and ongoing costs, inefficiency in fuel consumption and uneven lawn mowing, and limited mobility due to being tethered to an outlet or gas. To tackle majority of these serious problems, Lawn Genie comes off as a significantly better alternative.

**Need Analysis**

Automation has made tremendous strides in various industries and has become an integral part of modern life. With the increasing demand for technology to make our lives easier, the use of automation has become increasingly prevalent. From manufacturing to healthcare, automation has helped businesses to streamline their operations, save time, and increase efficiency.

One area where automation has proven to be extremely beneficial is in the maintenance of lawns. Maintaining a green and healthy lawn can be a time-consuming task, especially in warmer climates where grass grows quickly and requires frequent mowing. For many people, lawn care is a tedious chore that they would prefer to avoid. This is where automation comes in. Robotic lawn mowers have been designed to help reduce the time and effort required to care for your lawn. These mowers are equipped with sensors and artificial intelligence, allowing them to mow your lawn efficiently and accurately.

For farmers, who have vast areas of land to maintain, a robotic assistant can be a game-changer. Farmers spend a considerable amount of time cutting grass and removing weeds, which can be physically demanding and time-consuming. With the help of a robotic mower, farmers can save time, reduce their workload, and focus on other important tasks. These robotic mowers are not only efficient, but they are also environmentally friendly, as they emit fewer emissions than traditional gasoline-powered mowers.

This is where Lawn Genie comes into play. Lawn Genie is a fully automated robot that can handle routine, time-consuming lawn care tasks, freeing up the workforce for more important and creative work.

Lawn Genie operates using solar power, making it a more sustainable and eco-friendly option compared to traditional lawnmowers that rely on other sources of energy. The advancements in technology, changes in cost structure, supportive policies, and regulatory frameworks have led to the growth of solar energy in developed countries. Thus, it is necessary to transition from traditional energy systems to clean energy systems.

Moreover, the use of solar panels to generate electricity produces no greenhouse gas emissions, making it a step towards mitigating global warming. By adopting Lawn Genie, we can make an environmental impact and help create a cleaner and greener future.

The era of automation has arrived, and Lawn Genie represents our entry into this fully automated world. With the rapid advancements in technology, it is a unique and innovative way to simplify lawn care and make it more environmentally friendly.

**Literature Survey**

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| --- | --- | --- | --- | --- |
| Name | Paper title | Author and year | Technique | Results |
| Abhay Bedi | Implementation of Automatic Solar Grass Cutter in International Journal of Advanced Research in Electrical (IJARE). | Bidgar Pravin Dilip Nikhil Bapu Pagar Vickey S. Ugale  Sandip Wani  Prof. Sharmila M. | The design incorporates a microcontroller, several sensors, and a solar-powered charging system. | In consideration of the fact that the user may handle the robot at random times, the designers chose to use Nickel-Metal Hydride (NiMH) batteries as they provide a low charging current and prevent overcharging. |
| Suvansh Sharma | Design, Modeling and Control of an Omni-Directional Mobile Robot | Ioan Doroftei Bogdan Stirbu | In robot development, mathematical models are created to represent its dynamics and control algorithms are implemented to regulate its motion. The choice of control algorithm depends on the robot's requirements and takes into account its hardware limitations for proper operation. | The design, modeling, and control of an omni-directional mobile robot requires careful consideration of the robot's mechanical components, mathematical models, and control algorithms to ensure efficient and effective operation. |
| Pratham Mittal | Solar powered wireless multifunctional robots | Mohamed Ibrahim E .Deepthi,  M. Bindiya | Photovoltic cells to convert sunlight into electricity. | The proposed system expands operational range through the use of solar power and wireless cameras for cost-efficient live streaming. This versatile robotic platform can be used not only for surveillance and rescue operations, but also for tasks such as grass cutting. The system alerts the user of any potential intruders and can effectively handle various outdoor maintenance tasks. |
| Abhav Goel | 2D Lidar-Based SLAM and Path Planning for Indoor Rescue Using Mobile Robots | Xuexi Zhang Jiajun Lai Dongliang Xu Huaijun Li Minyue Fu | SLAM - Simultaneous localisation and mapping | The paper investigates the use of mapping and path planning for mobile robots in indoor rescue scenarios, and evaluates the performance of three SLAM algorithms (GMapping, Hector-SLAM, and Cartographer) in combination with A\* global path planning and DWA local path planning. The paper presents experimental results from simulated, emulated, and competition rescue environments, demonstrating the effectiveness of the SLAM and path planning algorithms. The findings may aid researchers in selecting suitable algorithms for developing SLAM systems in similar scenarios. |
| Aparna sood | Self-Efficient and Sustainable Solar Powered Robotic Lawn Mower | Srishti Jain  Amar Khalore Shashikant Patil | The proposed design uses an ATMEGA 328 microcontroller as the brain of the system and motor drivers (L 293dne) that controls the movement to create a robotic lawn mower that is powered from solar panels | The design proposes a solar-powered robotic lawn mower that is autonomous and does not require perimeter wires to maintain it within a lawn. It includes safety fetures such as an array of sensors to avoid and detect obstacles and works in either automatic or manual mode, with a preset pattern installed.Advantages of this system are used components are of low cost so and in bulk production and adding of few more sensors doesn’t makes any difference. but the disadvantage is that sometimes response of the system is too slow so in real time high end DSP processors is recommended that can process much faster |

**Objectives**

* Lawn Genie will be a robotic device for cutting grass that will be entirely automated and driven by solar power.
* Its advanced omni wheels will allow it to rotate and move laterally with remarkable agility, enabling it to navigate effortlessly when it encounters an obstacle or dead end.
* The application of Deep Learning will be employed to perform landscape segmentation and mapping, as well as to detect objects and determine the density of grass.
* It will be equipped with LiDAR sensor for providing a high-resolution 3D view of the surroundings.

**Methodology**

The methodology to achieve the objectives that has been set have been mentioned below:

**Phase 1: Developing an object detection and identification system**

The autonomous lawn mower will be equipped with an obstacle avoidance and object detection system that utilizes image recognition technology. The system will be able to determine whether an upcoming object should be classified as an obstacle or not, with the assistance of the SSD algorithm.

**Phase 2: Developing a Power Supply System:**

In order to make the most of the powerful solar radiation from the sun, we will arrange the solar panels at a 45-degree angle, and then use LDR sensors and a DC motor to fine-tune their orientation and maximize their exposure to sunlight. The panels will be responsible for converting the solar energy into electrical energy, which will be stored in batteries using a solar charger.

**Phase 3: Installation of rotating blade for proper grass trimming and omni wheels for all direction movement**

A properly oriented rotating blade at the bottom of Lawn Genie will be installed for even grass chopping. The hardware used will be sturdy, sustainable, heavy duty and replaceable in case of damage. In addition to this the advanced omni wheels featured in this device will provide a unique capability for movement that sets it apart from traditional wheeled robots. These wheels are designed to rotate in multiple directions, allowing the robot to move not only forward and backward, but also laterally and diagonally with remarkable agility. This means that lawn genie can easily navigate around obstacles or dead ends by simply shifting its orientation and moving in a different direction

**Phase 4: Equipping the device with LiDAR sensor for providing a high-resolution 3D view of the surroundings.**

LiDAR (Light Detection and Ranging) is a sensing technology that uses laser beams to measure distances and generate precise 3D maps of the environment. Equipping Lawn Genie with a LiDAR sensor can significantly enhance its ability to perceive and understand the surrounding world. LiDAR is commonly used in autonomous vehicles, drones, and robotics, enabling them to navigate and avoid obstacles with high accuracy and safety

**Phase 5: The application of Deep Learning will be employed to perform landscape segmentation and mapping, as well as to detect objects and determine the density of grass.**

Deep Learning is a powerful subset of machine learning that uses artificial neural networks to learn and identify complex patterns in data. By leveraging these techniques, it's possible to perform advanced image analysis and recognition tasks, including landscape segmentation and mapping, object detection, and density estimation. In the context of our lawn mower the Lawn Genie, the application of Deep Learning can be particularly valuable in detecting and measuring changes in grass over time.

**Work Plan**



**Project Outcomes & Individual Roles**

* A completely automated lawn mower powered by solar power, capable of detection and identification of any object surrounding it and installed with omni wheels allowing it to move in every possible direction

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| **Name** | **Role** |
| Abhay Bedi | Omni Wheels installation, Training and Testing of the model, Research findings, and Documentation |
| Abhav Goel | Chopped grass collection, final design optimization, Database Creation, Component Acquisition |
| Aparna Sood | LiDAR sensor, landscape segmentation and mapping, Arduino Script |
| Pratham Mittal | Research on the SOLAR tracking system, installation of panels responsible for converting the solar energy into electrical energy, |
| Suvansh Sharma | Model Building, Evaluation Metric, final interface development |

**Course Subjects**

* Manufacturing Processes
* Software Engineering
* Machine Learning
* Electronic and Electrical Engineering
* Artificial Intelligence

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