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Auto Saving Energy Robot Mower with Multi-Sensor Fusion Navigation

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***Abstract*: Automatic lawn mower is a device that help human to cut grass automatically. Due to rapid development, mainly robots have turn into an autonomous robot. In this paper, an automatic lawn mower is development with several features such as detection of lifting, rain false, day and night. The movement of the automatic lawn mower is based on a path planning technique. The robotic lawn mower is a promising development that is making the mundane chore of lawn mowing a safe and efficient endeavor. In this paper it is explain how sensor technology is integrated into the design of the robotic lawn mower to make the machine innovative, versatile and safe for domestic use. Beginning with need of robotic lawn mower and its role in domestic robotics, it will describe the fundamental components of the mowers design while incorporating technical data from prominent manufacturers. The specific sensors are incorporated into the mowers design to enhance the sustainability of machine.**

***Keywords*: IR Sensor, Mapping, Multi sensor fusion, Navigation, Robot Mower Ultrasonic Sensor.**

1. Introduction

Ultrasonic sensors and navigation for robot mowers is represented mainly in this paper. The proposed sensing system enables robot mower mapping under it is important task of localization and navigation for moving. A lawn mower mainly utilizing one or more revolving blades to cut a grass surface to an even height. The height of the cut grass may be fixed according to the design of the mower, but generally is adjustable by the operator, typically by a single master lever, and bolt on each of the machine's wheels. By muscle the blades can be powered, with wheels mechanically connected to the cutting blades so that when the mower is pushed forward, the blades spin, or the machine may have a battery powered as plug in electric motor. The common power source for lawn mowers is small internal combustion engine. Larger lawn mowers are mainly either self-propelled walk behind types, or more often, are ride on mowers, equipped so the operator can ride on the mower and control it. Two main types of blades are used in lawn mowers. Lawn mowers employing a single blade that rotates about a single vertical axis is known as rotary mowers, while those employing a cutting bar and multiple blade assembly that rotates about a single horizontal axis is known as cylinder or reel (although in some versions, the cutting bar is the only blade). There are several types of mowers, which is suited to a particular scale. The smallest types, unpowered push mowers, are used for small residential lawns and gardens. Electrical engine powered push mowers are used for larger residential lawns (although there is some overlap). Small tractors which sometimes resemble riding mowers, are larger than push mowers and are suitable for large lawns, although commercial riding lawn mowers (such as zero turn mowers) can be stand on types, and often bear little resemblance to residential lawn tractors, large areas at high speed in the shortest time possible. The largest multi gang (multi blade) mowers are mounted on tractors for large expanses of grass such as golf courses and municipal parks, although it is ill suited for complex terrain. Multisensor data fusion technique is an essential process to improve the autonomous capabilities of the modern robots. There is a considerable contribution in this area that shows how measurements from different sensors can be combined together to make the system more reliable and accurate. In the view of this, the literature survey is divided into different parts. The initial part deals with an overview of autonomous mobile robots and role of multisensor data fusion. In this multisensor data fusion and integration is differentiated and reviewed. Second part deals with the various advantages of multisensor data fusion in lawn mower robots. To explore the unknown environment, mobile robot needs to map the environment and to maintain the localization parameters. For mobile robot mapping, the significant assignment is to access the range information and second leading assignment is to convert the range reading into internal representation. The robot accept the internal information to update its state as it moves around. It supports the mobile robot to attain full autonomy so that it may operate without human intervene. It is an extremely difficult task for mobile robot to take the decision without updating the previous status of the environment as the environment may be highly dynamic. In such situations, the mobile robot system accumulates the local environmental information and continues work by fusion process.

2. Overview of sensor unit

Behavior based approach is required for robot controllers in order to perform the desired task in outdoor environment, which is normally dynamic and unstructured. To differentiate between mown and unmown grass, there is controller to check the

change in grass height using couple sensors incorporating with global coordinates. The robot keeps track of its local positioning using shaft and visual

A. Sensing system

1) Ultrasonic sensor unit

Ultrasonic sensors provide good range information based on the time of the flight (TOF) principle, mainly due to their simplicity and relatively low cost, they have been widely used in mobile robots for obstacle avoidance, map building and so on. This type of external sensor is very good in obstacles distance measurement. The main lobe of the sensitivity function is contained within an angle of 20 degrees. A number of tests that gives the range accuracy of the sensors is in the order of ±2cm. On IRM, set up a sensor array which consists of 12 ultrasonic sensors spaced 30 degrees apart. The ultrasonic signals can cover all the space around and satisfy the space requirement about which robot can detect the environmental signals. Infrared sensor unit and other sensors to overcome the ultrasonic sensor's blind zone, infrared sensors are added. The infrared sensors can detect obstacles within 20cm, which patch up the problem caused by the blind zone problem of ultrasonic sensors. This unit has 16 infrared sensors. Each infrared range finder has a conic view of 6 degrees which is the main lobe of the sensitivity function. This sensor has a useful measuring range of a target up to about one meter with high accuracy. A number of test shows that the range accuracy of the sensors is in the order of ±l cm. In order to save the DSP's resource, 16 infrared sensors are connected with DSP TMS320F2812's data interface 418 instead of the IO interface. This kind of architecture can also read the sensor's status at the same time, ensuring the real time capability of the system

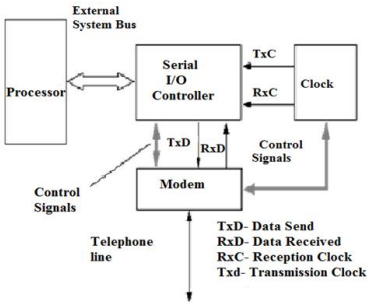

Fig. 1. Ultrasonic sensor unit

A sensor interface circuitry is to send and receive infrared pulses catches always the first retuning echo to process its amplitude. The circuit diagram is shown in the fig. 2.1 robot mower works in an outdoor environment, in which the temperature changes rapidly. The changing of temperature will affect the speed of sound. Therefore, a temperature sensor is used to guarantee the precision of the ultrasonic sensor.

3. Multi-sensor fusion

The intended controller mainly consists of five behaviors running concurrently. These behaviors, on getting stimuli from environment will be appropriately react to modify the motor actions of robot. The robot initially starts moving in the workspace, which is the basic behavior of robot. Robot continuous moving without any change in its direction until it perceives an obstacle or finds the goal. It always continues searching for goal, which is grass field and as it finds it, starts moving towards that. It continues searching for obstacle, which is grass field and as it finds it, starts moving towards that. The detection of goal is done by using camera, to find green color field using blob finder algorithm. When it reaches at goal, it starts executing mowing behavior along with other appropriate behaviors. To differentiate between mown and un-mown grass, the designed controller check for the change in grass height using sensors incorporating with global coordinates. The robot keeps track of its local positioning using shaft and visual Odometry, and that of global positioning it uses GPS. This type positioning information is used to traverse the grass field. The fusion of data or information from multiple sensors single over time can take place at different levels of representation. A useful categorization is to consider multisensor fusion as taking place at the signal, pixel, feature, and symbol levels of representation. Some of the sensors typically used in practice provide data that can be used at one or more of these levels. The different levels of multisensor fusion is used to provide information to a system which is for a variety of purposes e.g., signal level fusion can be used in real time applications and can be considered as just an additional step in the overall processing of the signals, pixel level fusion can be used to improve the performance of most image processing tasks like segmentation, and feature and symbol level fusion can be used to provide an object recognition system with additional features that can be used to increase its recognition capabilities. The most important problem in data fusion is the development of appropriate models of uncertainty associated with both the state and observation process. The focus is with the use of probabilistic and information Ultrasonic sensors provide good range information based on the time of the flight (TOF) principle, mainly due to their simplicity and relatively low cost, they have been widely used in mobile robots for obstacle avoidance, map building and so on. This type of external sensor is very good in obstacles distance measurement. The main lobe of the sensitivity function is contained within an angle of 20 degrees. A number of tests that gives the range accuracy of the sensors is in the order of ±2cm. On IRM, set up a sensor array which consists of 12 ultrasonic sensors spaced 30 degrees apart. The ultrasonic signals can cover all the space around and satisfy the space requirement about which robot can detect the environmental signals. Infrared sensor unit and other sensors to overcome the ultrasonic sensor's blind zone, infrared sensors are added. The infrared sensors can detect obstacles within 20cm, which patch up the problem caused by the blind zone problem of ultrasonic sensors. This unit has 16 infrared sensors. Each infrared range finder has a conic view of 6 degrees which

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4. Conclusion

This paper concludes that AutoSaving Energy Robot Mower with Multi-sensor Fusion Navigation

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