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HARMFUL MATERIAL DISPOSAL SYSTEM

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ABSTRACT: The paper intends to propose a system that will help the personnel in areas deemed dangerous and life-threatening to eliminate any harmful material that they encounter. The system proposed will be mounted on an unmanned vehicle that will be controlled through a Graphical User Interface (GUI). The system will have a water-jet cutting mechanism that will help to dispose off hazardous and life-threatening substances. A Global Positioning Sensor (GPS) will help in the localization of the entire system. The system can be further improved by interfacing additional sensors.

KEYWORDS : GPS, GUI, Localization, Water-jet cutting mechanism.

I. INTRODUCTION

Personnel in areas deemed dangerous often encounter explosive devices that may be life threatening. An unattended suspicious object, for example, can be an explosive device. It is very risky for a human to manually check whether the object is non-threatening. Our system aims to eliminate this discrepancy and hence make way for safe disposal of explosive objects.

II. LITERATURE SURVEY

To develop a fully automated Abrasive Water Jet Machining System (AWJM), various sensors need to be integrated for a multi-sensory approach. AWJM system [1] consists of four types based on their performance parameters. Each of these parameters was tested for an in-process condition monitoring AWJM system. The Acoustic Emission (AE) sensor is highly efficient making it an alternative for measuring the depth cut. The variation of AE signals exhibits a linear relationship with water jet pressure. Peak values in the frequency spectrum are found to be shifting as the abrasive flow rate changes. At higher abrasive mass flow rate, higher peaks are also recorded in the high frequency spectrum. Also, the impact of abrasive particles does not play a significant role in the generation of vibration.

The maximum material thickness that can be cut using an AWJM system is influenced by the velocity of the feed [2]. Wedge shaped aluminium bars were used as samples, and the cut thickness was measured using an electronic altimeter. At maximum water pressure and maximum feed rate of the cutting head, the quality of the abrasive material is not of much importance. There is no significant increase in efficiency of the water jet cutting process.

For example, red garnet is highly efficient, cost effective and comparable to other abrasives like diamond and sapphire.

The main challenges faced while considering accuracy of GPS localization are perceptual aliasing, camera occlusion and noisy GPS data [3]. The unreliability that is associated with GPS based localization can eliminated by making use of cameras that remove this ambiguity. Using standard techniques, the weights of the image obtained through cameras were calculated and the one with the highest score was chosen as suitable to the query image. A multi-sensory approach was used, which helped increase the accuracy by a significant margin up to a range of 7.5m.Thus, a multi-sensory approach that combines the advantages and removes the drawbacks present in the individual helps in achieving highly accurate and reliable localization.

III. METHODOLOGY

The block diagram of proposed system is as shown in fig. no. 1.

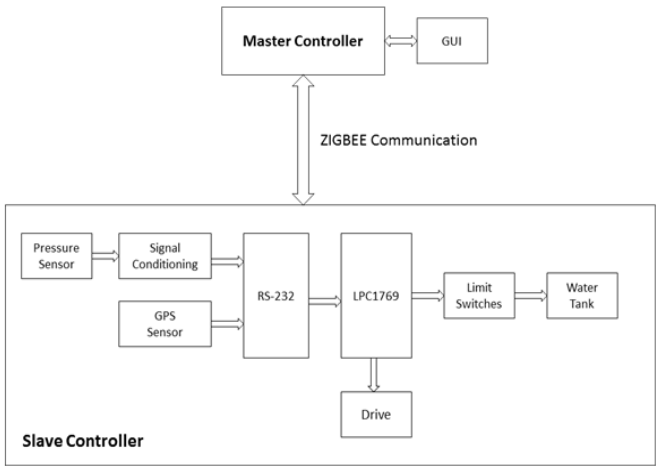

Fig.No.1: Block Diagram of System

Sensors used in our control system will communicate with our microcontroller through serial communication. LPC1769 has 4-UARTs numbering 0-3, similarly the pins are also named as RXD0-RXD3 and TXD0-TXD3.As the LPC1768 pins are

multiplexed for multiple functionalities, first they have to be configured as UART pins.

A universal asynchronous receiver/transmitter (UART) is a block of circuitry responsible for implementing serial communication. Essentially, the UART acts as an intermediary between parallel and serial interfaces. On one end of the UART is a bus of eight-or-so data lines (plus some control pins), on the other is the two serial wires - RX and TX.

Each sensor is tuned to operate in the range 4-20mA. This is achieved by additional signal conditioning circuit when required. Each sensor occupies a serial port of the LPC1769. Serial Communication is done simultaneously through the 4 COM ports.

A Graphical user interface (GUI) is developed to provide the operator with the following parameters of the system-

1) Pressure of the water jet cutter

2) Localization of the System (GPS coordinates displayed on a map)

Through the GUI, the operator will control the locomotion of the system. This will enable the operator to reach and dispose the harmful material from a safe distance.

The operator will also control the pressure of the water jet cutter, enabling him to penetrate and dispose off a wide range of materials.

IV. ALGORITHM

1. Raw values from the pressure sensor in the range 4 – 20mA are given to the signal conditioning circuit.
2. The signal conditioning circuit converts the input current from the pressure sensor to 0 – 5V signal.
3. This signal is given to LPC1769 in which the internal 10 bit ADC is used to convert it to a pressure value in the range 2000 – 6000Bar.
4. GPS module (Hemisphere A101) continuously transmits location info about the robotic system in the form of NMEA sentences to slave controller.
5. Slave controller transmits this data to the master controller where it is displayed to the user through the GUI.
6. Limit switches monitor the water level in the water tank. Upon reaching a lower threshold level water starts filling into the tank. The operation is stopped upon reaching an upper threshold level.
7. Locomotion of the robotic system is controlled through a Roboteq MDC2230 brushed DC motor controller.

V. CONCLUSION

By the end of this project, a control system will have been developed for a robot that can be used for disposal of harmful materials autonomously.

The developed control system will continuously monitor the pressure of water required by the water jet cutter, and maintain the required amount.

Furthermore, the GPS interface will ensure human control without their actual presence in a predefined radius around the material to be disposed.

The GUI developed will make the entire system user friendly and display data such as the position of the robot, and the water pressure in the water jet cutter in an easy to understand manner.

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