Swarm Robotics: A New Framework of Military Robots

M Sangeetha¹, K Srinivasan²
¹Assistant Professor, Department of Electronics and Communication Engineering, IFET College of Engineering, Villupuram.
²UG Scholar, Department of Electronics and Communication Engineering, IFET College of Engineering, Villupuram.

Abstract. In Industries robots are programmed to perform specified tasks like and place, packaging, transporting etc. Every robots need to be programmed individually to accomplish the task given. In the proposed work one master robots is designed and programmed in such a way that can train number of slave robots sequentially to perform multiple tasks at different processing lines of an industry this reduces the complexity in programming individual robots for different operations and also without programming the slave robots. This Robot plays a vital role in Industry Automation. Servomotors are used to achieve rotational motion of the robotic arm and Lora module to train slave robots. A robot is a machine that can perform task operation. A robot is a machine can perform specific task automatically or the guidance. The project proposes robotic vehicle that has an intelligent built in its that it directs itself whenever an obstacle comes in its path. An ultrasonic sensor is used to detect any obstacle in front of it and sends a command to the ArduinoNano.

1. Introduction

Robots are used in different fields such as industrial, military, space exploration and medical application. The robots could be classified as manipulator robots and cooperative with other Parts of automated or semi-automated equipment to achieve tasks such as loading, unloading, and assembling. Generally robots designed built and controlled via a computer or a controlling device which uses a specific program or algorithm.

Programs and robots are designed in a way that when the program changes, behavior of the robots changes accordingly resulting in a very flexible task achieving robots. Every day, we meet with many devices which combine various fields of engineering. These fields of the human knowledge are being developed constantly; there are many researches, new discoveries and creations. It deals with the system composed of the series of the robots; it stimulates and explores their behavior, interaction and cooperation.

Lora is used for main task of the top layer will be communication with other robots or a system realization of the military robotics and other parts of the high level of control. In the middle level will be separating the other level hardware form software layer and will be establishing the abstraction.

2. Related Works

For the purpose of Global Navigation in the outdoor areas the GPS module is used, while the local Navigation makes use of the quadrature encoder located on the shaft of the motor.

Since it is essential to take care of the battery during use of the motor. Since it is essential to take care of the battery during use to avoid the possible damage, the platform is equipped with a device which measures the electric current is also being measured. The 32bit microcontroller STM32F4 with core ARM Cortex M4 was chosen for the control task on the middle level.
It provides enough power and other specification such as memory, peripherals, and number pins to ensure the required performance. This version includes the Wi-Fi and Bluetooth module, which is used for communication with other robots or systems.

3. Proposed Work

The movement of robots will be stop whenever there is an obstacle is present on its path which can be detected by ultrasonic sensors.

Here we are utilizing servomotor to pivot the sensor up to 180 degree or 360 degree. The detail data is given in the accompanying subtopics which will assist you with understanding the entire framework and its plan.

MASTER ROBOTS

![Diagram of Master Robot](image)

Fig.1 Master Robot

Robots is planned and customized so that can prepare number of slave robots successively to play out various undertakings at various handling lines of an industry. This decreases the intricacy in programming singular robots for various activities and furthermore without programming the slave robot.

Then further the distance is calculated using the formula. \( D = C \times T \)

\( D \) is the measured distance.
\( C \) is the propagation velocity (Rate) in air (speed of sound).
\( T \) represent time.

The transmitter discharges a 8 eruptions of a directional 40KHz ultrasonic wave when activated and begins a clock. Ultrasonic heartbeats travel outward until they experience an item, The article makes the wave be reflected back towards the unit.
SLAVE ROBOTS

Servomotors are used to achieve rotational motion of the robotic arm and Lora module to train slave robots. The venture is plan and assembles an obstruction evasion automated vehicle by utilizing ultrasonic sensor for its movement. A robot is a machine that can perform task activity.

4. Implementation
It consists of a simple hardware platform on which Arduino Nano is placed as well as a free code editor. Hence it is designed for the people in such a way that they can use it without necessarily being an expert programmer. Arduino offers an open-source electronic prototyping platform it is anything but difficult to utilize and adaptable for people groups who are amateurs in mechanical technology field with both the product and Equipment point of view.

Fig.2 Slave Robots

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Fig.3 LORAWAN Module
In this work this sensor has been used to detect the presence of human being. This sensor needs 5-20 Volt DC supply to operate and if any motion and if any motion or change in infrared radiation is sensed, it provides a high DC output voltage 3.3-5 volts, otherwise the output pin goes low zero voltage. The Sensitivity of PIR Sensor varies between 3-7 metres; hence the sensor is too kept in such a place so that it can sense the presence of human body inside the home.

**Wide operating voltage range from 4.8V to 20V.**
- High reliability.
- Adjustable sensitivity or detection distance.
- Adjustable output time delay (Adjust time the output will remain high after the sensor detects a signal).

**Advantages**
- Small in size and compatible.
- Economic when compared to humanoid robots.
- Efficiency is more and time taking is less.
- No complexity in circuits and component.
5. Result and Discussion

- Master robots carries the information transfer to internet application can be updated.
- Slave robots collecting the message Transfer to the Master Robots.
- To avoid obstacles in the path.
- To provide communication among robots in longrange.
- We meet with many devices which can be used in various fields of Engineering.

![Robot Communication](image_url)

Figure 6: Robotics Communications

6. Conclusion

The Project will have more Advantages such as completing the task is less time when compared to the task completed by single robots. LORA-WAN Module will help us to communicate for longer distance around 10 km the Efficiency of this project is very good. Instead of doing a work by single robots, it is more efficient and easy to complete a work with multiple robots. The Project is not permitted for two only robots only; we can connect as many as robots together depending upon the complexity of the work.

References

[1]. Evans, W. C., G. Mermoud, and A. Martinoli. "Comparing and Modelling Distributed Control Strategies for Miniature Self-Assembling Robots". Proceedings – IEEE International Conference on Robotics and Automation. SCOPUS. Web. 24 Jan. 2017.
[2]. Ozana, S., and T. Docekal. “PID Controller Design Based on Global Optimization Technique with Additional Constraints.” Journal of Electrical Engineering 67.3 (2016): 160-8. SCOPUS. Web.
[3]. Sawicki, A., Walendziuk, W. and Idzkowski, A. Estimation of the object orientation and location with the use of MEMS sensors. Proceedings of SPIE (2015). Volume 9662.
[4]. Luo, Chaomin, et al. "A novel lidar-driven two-level approach for realtime unmanned ground vehicle navigation and map building." IS&T/SPIE Electronic Imaging. International Society for Optics and Photonics, 2014.
[5]. Rubenstein, Michael, Christian Ahler, and Radhika Nagpal. "Kilobot: A low cost scalable robot system for collective behaviors." Robotics and Automation (ICRA), 2012.
[6]. Kudělka, Miloš, et al. "Social and swarm aspects of co-authorship network." Logic Journal of IGPL 2012.
[7]. Pham, D. T., et al. "The bees algorithm-A novel tool for complex optimisation." Intelligent Production Machines and Systems-2nd I* PROMS Virtual International Conference 2011.
[8]. Wei, Hongxing, et al. "Sambot: A self-assembly modular robot system." IEEE/ASME Transactions on Mechatronics 2011.
[9]. Zezulka, F., Bradac, Z., Fiedler, P., Sir, M. Trends in automation - Investigation in Network control systems and sensor networks. (2010)

[10]. Kimchi, Gur, et al. "Sense and avoid for automated mobile vehicles." U.S. Patent Application No. 14/225,161.

[11]. Poli, Riccardo, James Kennedy, and Tim Blackwell. "Particle swarm optimization." Swarm intelligence 1.1 (2007)

[12]. Tsankova, Diana, et al. "Immune network control for stigmergy based foraging behaviour of autonomous mobile robots." International Journal of Adaptive Control and Signal Processing 21.2-3 (2007)

[13]. Dorigo, Marco, Mauro Birattari, and Thomas Stutzle. "Ant colony optimization." IEEE computational intelligence magazine 1.4 (2006)

[14]. Kornienko, Sergey, et al. "Cognitive micro-agents: individual and collective Perception in micro Robotic swarm." Proc. of the IJCAI-05 Workshop on Agents in real-time and dynamic environments, Edinburgh, UK. 2005.

[15]. Shin, Erol. "Swarm robotics: From sources of inspiration to domains of Application." International workshop on swarm robotics. Springer Berlin Heidelberg, 2004.