Prototype Development of Swarm Bot for Defense and Medical application

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Abstract – Design of Swarm bot is an initiative towards the synchronized performance of multiple bots as a total system consisting huge numbers of plain real-time bots. It is observed that an expected groupwise behavior is expressed from the interactions between the bots and the master device. The head posture movement is used to send the signal from the master device to communicate the slave devices. This methodology has come out in the field of artificial swarm intelligence, as well as the bio-inspired researches of insects and other fields in nature with the occurrence of swarm behavior. This process depends on the master-slave concept to operate the whole system. The wireless communication utilizes the SPI (Serial Peripheral Interface) protocol with radio waves in the range of 2.4-2.5 GHz. The ISM (Industrial Scientific Medical) band is used for the communication purpose.

Keywords – Swarm bot; Master-Slave; Wireless; Remote location.

1.0   Introduction

Swarm bot is the way of presenting the workflow mapping of several bots as a system consisting huge numbers of physical bots. It is seen that a required team appearance comes out from the connectivity between the automated systems and wireless connections of bots with the main controller. This approach is implementable in the application area of artificial swarm intelligence and other fields such as medical and defence. The instructions about 'Swarm Bots' is Assembly and Co-operative Transport which can be prepared as our own master and slave bot. The slave will follow the instructions of master robot and the master robot will be controlled with our android devices or through designed application softwares. It is a smart and intelligent automated system to monitor human activities. We are moving towards the goal to achieve the controlling of a group of slave bots in fully autonomous way so that they locate, approach and connect with an object. In Swarm robotics field, in a distributed and decentralized way multi-robotics is involved or participated in the form of large number of robots. The main application-oriented goal of the Swarm-bots is to study and understand the controlling of the slave bots assembled into structures. Swarm-bot is made of master and slave where the master controls the slave using Radio Frequency wave operated modules to carry out the dedicated job.

A Swarm-bot is connected with number of identical robots, called slave bots, which are wirelessly connected. The Swarm-bot is present with self-arranged feature. This challenging work initiates the functionality of the Swarm-bot assembly with one master and two numbers of

slaves as the prototype development and gives presentation about its application as transportation bot in defence and medical fields.

The bots in the swarm configuration must have some primary functions-

1) Interconnection among swarm bots: Participated bots in the swarm connection exchange the knowledge with each other and cultivate the facts to the total swarm through self-operated nature resulting in the swarm-level cooperation.

2) Keeping away from collision between swarm bots.

3) Coordination between bots.

There are some more features of swarm bots that fit neither of the above mentioned categories.
• Recovery process allows the swarm to get rid of different issues caused by short-falls of each and every bots. The aim is to almost eliminate the effect of robot performance failure on the remaining part of the swarm to improve the overall reliability, robustness, and performance.
• Reproduction process by its own allows an array of bots either to create newer design of robots or mimic the pattern generated from many other systems. The aim is to increase the self sufficiency of the swarm by reducing the requirement of a human operator to create new bots.
• Human-swarm interaction gives allowance the humans to operate the robots in the swarm or collect information from those bots. The connectivity can be set remotely, such as through a computer such as through visual or air medium.

2.0   Methodology

Construction of Mechanical Structure:

• Assembly of autonomous controller unit
• Assembly of different types of ambient sensors
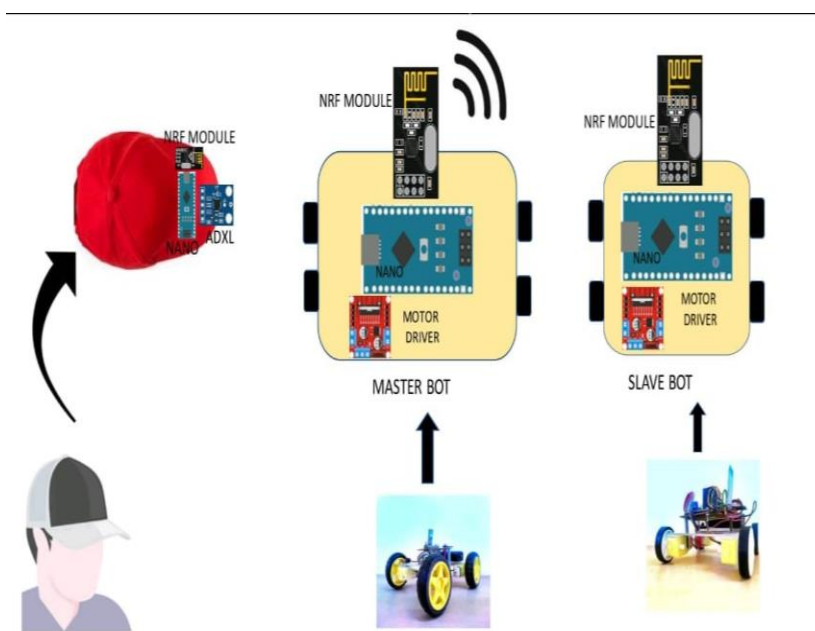• Assembly of different types of communication protocol

Fig 1: Schematic Diagram of Robotic car representation of the swarm robotic system

Synchronized location shifting:

This work finds the challenges of
a) The controlling methods to separate slave bots to connect with an object and/or with each other.
b) The process of having a swarmbot or a group of swarm-bots to send an object towards a destination.
The design and effectiveness of a hybrid control mechanism for operating a self-arranged group of slave bots engaged in a collaborative transmitting task that have already been nurtured in simulation. The issues has been classified into the categories of controlling the steps.
1. Slave bots that can self-manage themselves. Assembled slave bots can locate the target during transmission.
2. Assembled slave bots those are not able to locate the target during sending, uses one master and one slave microcontrollers.
3. Interfacing is included with optical avoider sensor with swarm bot.
4. Development of SPI communication among swarm bots.
5. Coordination among the swarm bots. Transportation issues of material is the only limitation.

Fig 2: Pictorial Robotic car representation of the swarm robotic system

Fig 2: prototype of the head posture movement to operate swarm robotic car

Specified jobs in particular regions Swarm robotics is very necessary to apply in border areas. In the no man's zone large areas are distributed with arrays of robots, and they act in group to complete the work. In this specific areas such as collecting information and act accordingly is the main function to defeat the terrorists.
• The hazardous zones:
Attaining an assignment in hazardous areas is not easy or safe for the human beings. It is acceptable to send robot swarms instead, in those risky zones. An example can be looking for hazardous objects in unreachable fields.
• Tasks scalable up and down:
Utilizing swarm robotics in jobs that can be scaled up and down according to the ambience is very useful because if a task is being scaled up due to a particular reason, the count of bots in a

swarm can be increased and if a task is being scaled down then the count of bots can be decreased. Natural disasters can scale up very quickly as an example.

• Jobs with redundancy requirement:

Redundancy is a basic criteria of swarm robotics and because of robustness represented by swarm robotic setup. The robots can adjust with the performance failure of other bots. They should do their work continuously and the absence of some members should not have any effect on the outcome. In the zones mentioned above, there are different types of tasks those can be done by swarm robotic setup.

3.0 CONCLUSION

Through this prototype development the observation has been achieved that the master-slave is implemented. The wireless connection between master device and the slave device is made through transceiver pair using radio waves. The places which are not reachable by human beings can be tracked and monitored through this kind of devices in a group.

4.0 FUTURE SCOPE

- By increasing the number of slave devices in different forms, shifting of bulk-sized and heavier objects can be accomplished.

- These swarm bots can be used for various food delivery operations in the restaurants.

- The utilization of swarm robotics can be extended to serve a nation through military services. This will reduce the number of casualties from a war.

5.0 References

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