

Collision Avoidance of Intelligent Service Robot for Industrial Security System

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Abstract

Presently, artificial intelligence machine has drawn a great attention towards computing research. Our research is focused on collision avoidance (static and dynamics collision) and alarm security system in industrial area. As service Robots are used for increasingly complex tasks, environments and carry heavy work load in populated areas with moving obstacle source to destination in many service applications. In this research, the collision avoidance system is developed to avoid unpredictable static and dynamic obstacle. Avoidance collision is basic requirement for the service robot. This system of service robot collision avoidance to calculate the track and identify the unpredictable obstacles by the camera vision between the areas in front and another track give towards destination. This system of service robot provided avoidance from striking with walls, peoples, door any static and dynamic obstacle, if any expected obstacle striking to service robot, camera detect closest obstacle to its track then service robot turn on its alarm security system.

Keywords: *Microcontroller, IR sensor, web camera, Alarm security system, stepper motor.*

1. Introduction

The intelligent security Robot becomes great interest and important subject. It has been implemented in many industrial areas. The basic importance of this service Robot is that the fundamental part to avoid the collision of obstacle, calculate the distance source to destination and alarm security in different service applications [1]. The service robots used for helping to the workers in the fields of science and industrial areas, such as Medicine and some other factories. Last four years service robot was expected to give all variety of service in human daily life. In the fundamentals, the developed service robot such as security service, remotely operated camera vision system carry load and human robot interaction and so on[2,3]. Before

time of the modern industries, there were the systems of trolley used for carrying the loads from one place to another place in the industrial area [4]. These trolleys were run by the human or by the animals. Day by day technology improves this hazardous work of the pulling the trolley by the man or animal was replaced by invented service robot. In the above scenario service Robot systems when it carry to load source and go to destination.

The camera visualize its track and calculate the distance source to destination, if it detects the static obstacle and moving obstacle in its path or any person try to touch the service robot then robot security alarm system will be activated and turn on alarm system [6,5]. After one minute service robot find another suitable path and it takes the load reach safely to destination. The idea of this research is to enable the service Robot to operate in highly frequented human atmospheres. Industrial security systems provide reliable and safe, relaxed living and working atmospheres for workers [7]. The digital visualization technique used for safety Industrial area in service robot. In this robot security system we are using single camera for real time tracking. The single camera in the system monitor whole path source to destination and also can track persons or wall, any obstacle (static and dynamics) in industry atmospheres [8]. Most effective Service Robot systems industrial area based on effective sensor, camera and alarm security system depended calculate distance, alarm security system, collision avoidance with respect to operate safely in populated industrial environments [9]. The service Robot camera and sensor calculates the distance between the moving obstacle and service Robot. To apply collision avoidance techniques that proposed to avoid the collision avoidance between services Robot and

extended to the moving obstacle [10]. If any obstacle or any person occurs in the track of movement of the service Robot, then camera take vision the track and service robot stops turn on alarm security system until the obstacle cannot remove within one minute after one minute change the path of the movement.

In modern industries there are many different ways for carrying the load one place to another place such as conveyer belt frequently and ladders using now days in all these variety of ways, these are the dedicated path for the transfer the load from source to destination, because of the huge mechanical and inflexible structure the nobility of these ways is very much restricted but they do not have any security and digital visualization system.

2. Related Work:

There are several different techniques implemented to avoid static and dynamics obstacles, alarm security system and digital visualization in different areas service robot are well defined. They are distinguished in two important classes: one is avoiding the collision and other is security system. The proposal based approach: Hu et al. first purposed a track about the moving obstacle and the statics obstacles are considered in additional phase that govern the service Robot- speed on the track about the dynamics obstacles and static obstacles [13]. An additional very important standard approach is referred as anti collision vehicle control system. First the vehicle cover the distance safely without any collision if any huge traffic in road so if slowly down its acceleration some emergency its will stop, vehicle cover distance without any accident. Any object must be recognized by visualization system and required to be predicated within limited time. Service Robot visualization system and IR sensor to sense the obstacles in respect to slowly prevent the service Robot and to stop the collision surrounded obstacle before purposed .The three important layers navigation idea has established to complete three important areas of tasks [11, 12].

We have designed this security sensor robot which is used to carry the loads. It is service Robot based system. It is very flexible and moveable service Robot because we using stepper motor in his wheels and it use the sensors. It uses the Infrared sensor for the object avoidance and visualization system use for path detection and trough the software programming it changes its track as to take the object at its destination point and alarm security system when it stops without destination its security system activated. It is hardware and software based control system, which help us in the situation, where the destination point is not the same all way. In this kind of situation it helps us to not the change the whole mechanical infrastructure. Just we have made some change in the software and we can achieve our goal [14].

Adrian Cabrera et al. he developed the warning collision system for the vehicle, he focused on time base measurement asses and front and rear collision threats and he develop collision avoidance technique safety for crash vehicle in the highway [15]. Holler et al. applies the modified track planner to avoid expected path of human. Such expected position stops the predicated

planner from addition of original waypoint at near position [16]. Bennewitz et al. apply the typical technique learned motion arrangement of persons Hidden Markov Models are evaluated to assess forthcoming movements. The probabilistic certainty is inserted in to route planning process [17] J. Pérez et al. apply the new technique for backtracking reverse and forward path following based on fuzzy controllers, he implemented the shortest or faster route avoid collision vehicle fuzzy logic system to resolve the unexpected road situations and good performance obtained in trial [18]. Stefano Ghidoni et al. apply the visualization technique for tracking of dynamic obstacles and face detection trough camera, the camera vision unidirectional and tracking the moving object and vision sensor detect the any obstacles and people walk [19]. Kyunghoon Kim et al. apply the typical alarm security technique he purposed the alarm security system in the Korean oil industry, he control the abnormal situation in oil industry if there is any fire chance or fire situation robot turn on alarm security and alarm is ringing [20].

3. System Model:

We designed the modern service robot for industrial areas that able the avoid static as well as dynamic collision obstacle and having alarm security system this robot is useful for next generation industrial areas. System model figure shows below architecture of the service robot that can using single web camera and tracking path many other supporting designed purposes such as people reorganization system and collision avoid system detect the dynamic and static obstacles tracking path. The alarm security system also integrated if any obstacle or people try to touch or stop alarm system robot turn on its alarm system this technique to build the reliable robot.

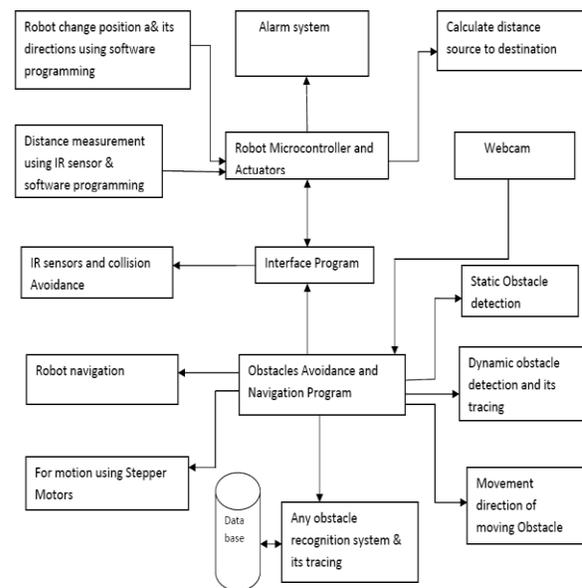


Fig. 1- Model

Software programming used for the turn robot direction and also avoid the collision purpose. We designed database recognized peoples and obstacles. There are also interface program manage between robot movement and its microcontroller. Service robot movement source to destination safely and achieved its goal.

4. 8051 Microcontroller:

The 8051 microcontroller device is used to separate memory space for the data and code as well.

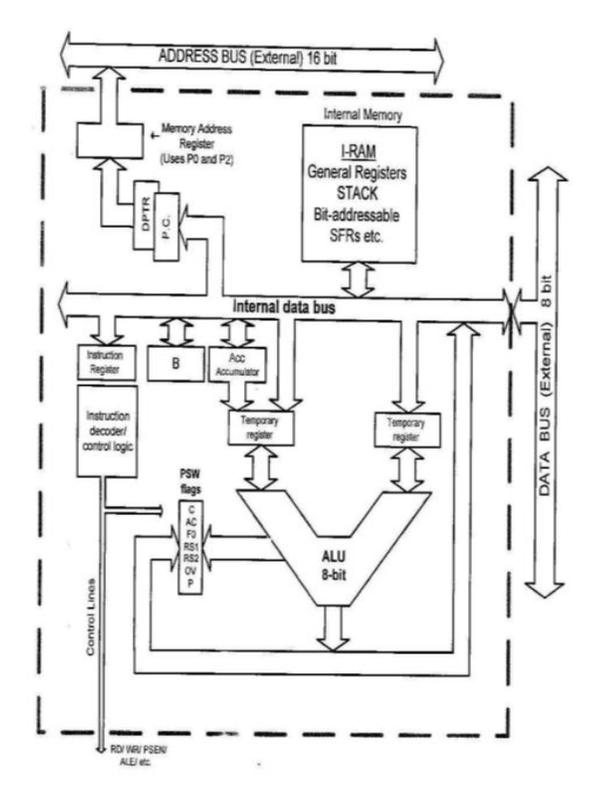


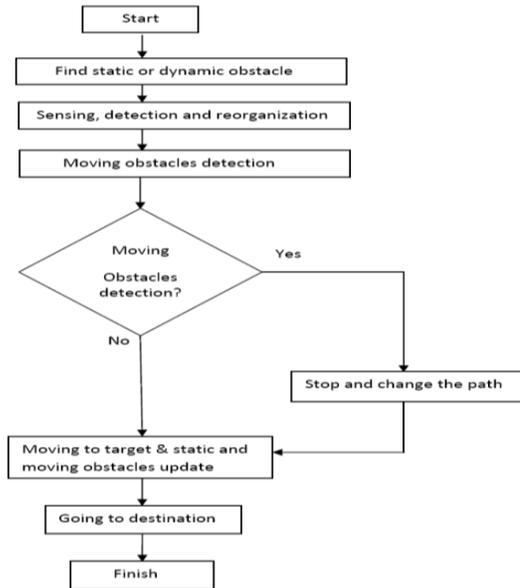
Fig.2. Micro-controller

It has been referred as external memory and chip memory. Areal implementation the external memory is contained within the microcontroller chip. It has been used the definition of external and internal memory reliable to the 8051 microcontroller instruction that function over memory. The split-up of data memory and program design is slightly rare. This separation design is known as Harvard design.

5. Experimental Results:

The experiments of collision avoidance (static and dynamic obstacles) have been tasted for service robot to delivery by university of electronic science and technology china embedded system lab. We tested our service robot different distance area for industrial environments.

Path tracking, obstacles and people reorganization based system and database used for the images have been stored. The small space of area, obstacles and people move in front of service robot, back side service robot and also straight walk service robot these approaches to robot. We tasted the service robot three different speeds (fast speed, medium speed and also low speed).

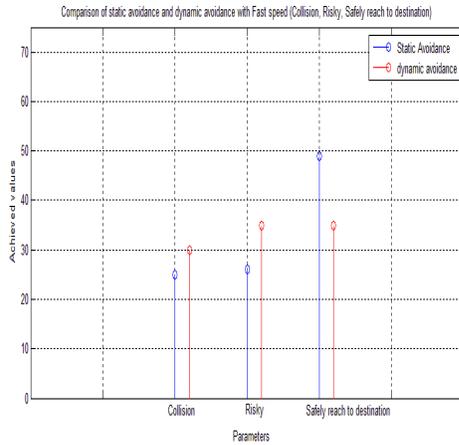


We did 100 trials in our laboratory during the 15 minutes most of trials is successful .According to our experiments we making the result table and we simulate the graph in Matlab software.

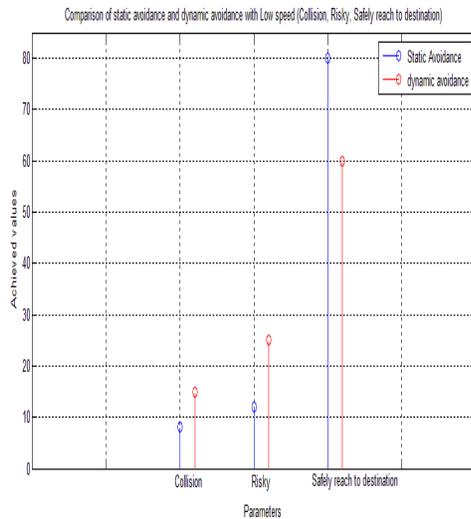
Table

100 TRIAL RUNS: OVER- ALL SUCCESS RATE DURING 15 MINUTES

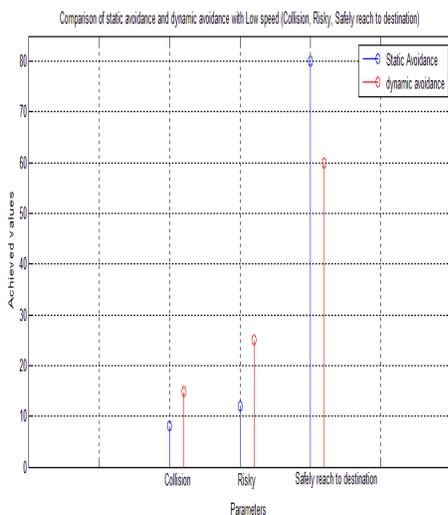
No	Condition	Speed	Direction	Distance to close object	Collision	Risky	Safely reach to Destination
1	Static avoidance	Fast	Straight	148mm	25	26	49
2		Medium	Straight	666mm	15	15	70
3		Low	Straight	999mm	8	12	80
4	Dynamic avoidance	Fast	Straight	200mm	30	35	35
5		Medium	Straight	500mm	22	28	50
6		Low	Straight	1042mm	15	25	60



Graph-1



Graph-2



Graph 3

6. Hardware (Functional):

Eventually, the system to avoid of moving obstacle is complete and execution. At the time of running this project the stepper motor is used to carry much load. Stepper requires more power to increase in load. The load and power of stepper is directly proportional. IR sensor senses different types of frequencies, web camera and alarm security system which interrupt the controller and controller takes action on the basis of sensor information and service Robot misguided from the path. 6 volt nickel cadmium rechargeable batteries have much heavier in weight in the service Robot. These batteries have long life but discharge quickly because of current consumption of motor.

7. Conclusion:

We are focused in this paper to present new method of static and dynamic obstacles collision avoidance, digital visualization path tracking and alarm security system for service robot in industrial area. The proposed technique is applied for not only moving obstacle but also static obstacle and also having advance alarm security system. New technique has been introduced to static and dynamic obstacles with alarm security system and digital visualization for service Robot in populated atmosphere. The service robot travelling direction is depending on IR sensor and software programming. If service robot detects the obstacle in its path then it turns on security alarm, after few moments it changes another suitable track and carry load from source to destination safely. In this paper, we introduces the sensor, security alarm and camera system to detect the obstacle in the path of its movement if any obstacle striking, it's turned on alarm after few moments and automatically finds the suitable path.

After tested the project the results has been achieved. This research has been carried out to design a service Robot which can detect any obstacle , take view the tracking path which occur in the path of service Robot and sensors senses the alternative route to carry the load to destination safely .The experiment performed on the basis of the following three environments.

- (i). Moving obstacles existed on the path of the service Robot in particular environment.
- (ii).Static obstacle and moving obstacle are mixed in smart space.
- (iii).Walls and doors exist on the service robot paths in the surrounding environment.
- (iv).Tracking digital visualization whole path source to destination.
- (v). Alarm security system if the service robot stop any obstacle or people alarm security system is turn on alarm. We can increase the ability of this project by modify according to the theory of artificial and computer vision. We can attach a wireless camera on service Robot to work according to the theory of artificial intelligence and computer vision.

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