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Design and Development of Forklift in Manufacturing

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ABSTRACT: Material handling is a necessary but expensive activity in factories. Autonomous Robot technology can help reduce the cost and relax humans from exhaustive job of driving Forklifts. In this topic we describe the. This paper addresses a design and implementation of an autonomous forklift and working prototype of an autonomous fork lifter industrial robot. It includes four encoder DC motors to move the whole assembly and two DC motors to run the lifter. This system is based on a chain mechanism used in moving the fork. The body of the system is made up of aluminium and partially Iron alloy. In order to ensure the smooth movement of the robot, the body of the system moves with the help of continuous track or tank treads. It is also used the camera vision to detect the boxed luggage to be replaced somewhere. The camera and the whole system operate with a raspberry pi microcontroller. Using human labour both directly or inside a fork lifter risks both human life and industrial economy in terms time, cost, and efficiency. To solve this problem an autonomous fork lifter robot can be best suited. This robot can do all the work using its vision. By using this robot in ware houses or other places to shift the luggage, a very important problem of modern industry may be resolved. The Robot can perceive the 3D dynamic world and can plan its motion autonomously to lift materials from a source to target locations. Dynamic map is built, thus enabling the robot to avoid obstacles and reach target locations safely.

KEY WORDS: Fork lift, design, material handling system

I. INTRODUCTION

In general, the forklift can be defined as a tool capable of lifting hundreds of kilograms. A forklift is a vehicle similar to a small truck that has two metal forks on the front used to lift cargo. The forklift operator drives the forklift forward until the forks push under the cargo, and can then lift the cargo several feet in the air by operating the forks. The forks, also known as blades or tines, are usually made out of steel and can lift up to a few tons [1-3]. Forklifts are either powered by gasoline, propane, or electricity. Electric forklifts relay on batteries to operate. Gasoline or propane forklifts are sometimes stronger or faster than electric forklifts, but they are more difficult to maintain, and fuel can be costly. Electric forklifts and hydraulic forklift are great for ware house use because they do not give off noxious fumes like gas powered machines do. A forklift is a one type of power industrial truck that comes in different shapes, sizes and forms. A forklift can be called a pallet truck, rider truck, fork truck or lift truck [4-5]. Yet, the ultimate purpose of forklift is the same to safely allow one person to lift and moves large heavy loads with little effort. Hydraulic forklift also known as hydraulic hand pallet is a tool used to lift and transport heavy load for long distance switch the help of pallet. Pallet jacks are the most compact and modern form of forklift and are intended to move heavy and light weight material within a ware house. For the purpose of training, a forklift is a small or large industrial truck with power operated platform. Like other forms of forklift hydraulic forklift doesn't require any kind of electric power source or diesel and gasoline because hydraulic forklift works on principle of hydrostatic force transmission. Lifting of heavy loads are accomplished with the help of hydraulic cylinder in the forklift. Cylinder is generally fitted at lower parts of fork. Forklifts are most often used in warehouses, but some are meant to be used outdoors. The vast majority of rough terrain forklifts operate on gasoline, but some use diesel or natural gas. Rough terrain forklifts have the highest lifting capacity of all forklifts and heavy-duty tires (like those found on trucks), making it possible to drive them on uneven surfaces outdoors. Forklifts have revolutionized warehouse work [6-7]. They made it possible for one person to move thousands of pounds at once. Well-maintained and safely operated forklifts make lifting and transporting cargo infinitely easier. This is the general description of a normal forklift infinitely easier. Powered industrial trucks is a

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common term referring to forklifts, container handling trucks, reach-trucks, turret trucks and the like. Since their introduction forklifts have been an integral ingredient for materials handling across a multitude of industries. Global injury/fatality data identifies forklifts as a prominent occupational hazard that has occurred as a by-product of automation and bulk material handling [8-9]. With the introduction of forklifts came a shift in plight of materials handling towards adopting a bulk oriented approach. This derived jointly from the need to improve productivity and to reduce the instance of workplace manual handling injuries. As a result, a niche` market was created for specific plant and equipment to cater for such demand, but also unfortunately released a new ream of hazards to the workplace. A lack of consideration of the interface between pedestrian workers and forklifts in the workplace has resulted in forklifts comprising many of the more serious injuries and fatalities in the workplace. These effects have been felt throughout industries ranging from manufacturing to retail environments, and require an array of engineering and administrative interventions to combat the exposed risks [10]. These interventions should extend from the current hygiene and ergonomic focus and look towards integrating automated logistics planning, with on-board intelligent vehicle technology.

II. METHODOLOGY

The majority of research for forklifts to date has been directed towards improving efficiency and technical capabilities. Subsequent development in this area has seen the introduction of narrow aisle applications, improved engine efficiency and maintenance access. From the manufacturer's perspective ergonomic considerations has also been a part of the development process. Ergonomic consideration in the main is aimed at reducing the instance of whole-body vibration and static muscle loads. This tangible quality adds credence to claims of improved productivity and as a result pays for its own development costs. However, the real advancement has occurred as a result of technological advancement in the form of a system known as SAS (System of Active Stability). This system actively monitors and adjusts the rear axle so as to prevent it from tipping over. The active mast control function moderates mast and fork function, so as to ensure load stability. Improved performance, better ergonomic consideration closely integrated within a restyling regime, are the features of caterpillars new three-wheeled electric counterbalanced lift trucks. This also provides for operator conveniences like a low entry step and large grab handle. Directional control has also been overhauled by the use of an electric forward/reverse shift, which allows for an almost instantaneous change of direction. Added to this is the introduction of double coned synchromesh gears, which ensure that gear changes are smooth and load stability isn't compromised. Hydrostatic steering virtually ensures its product will require less maintenance, lower running costs and subsequent result in higher productivity. Other design features are the torsion support system that increases mast stability when carrying swinging loads by as much as 30%. Electrically powered models benefit from a multi-function joystick control referred to as Load Control (LLC) which allows for smooth fingertip control of all hydraulic functions.

III. WORKING PRINCIPLE

Fig.1. shows forklift material handling system. The wheel shaft is connected with arrangement of a motor. This motor is used to run the vehicle. Battery is connected to the motor. The motor is connected to the worm gear to increase the torque and is directly coupled to the wheel by means of a bearing block which runs the vehicle. Motor is controlled by the control unit. This vehicle causes no pollution. In front of the way the forklift arrangement is mounted. The lead screw is used lift the fork and used to move up and down. The most important consideration of designing a fork lift is the safety, while the forklifts is during the loading and moving stability system consists of 3 point of contacts ,2 front wheel drives and supporting the real wheel contact axle arranged on safely mounted. The components are used in this forklift material handling system: Wheel hub, Wheel Axle & Supporting Frame, Handle Rods, Vehicle Motor, Chain and Sprockets, Raspberry pi, Lifter Motor, Lifter sliders, Supporting Rods, screwing mechanism, Tires, Wires, Mounts, Fixtures & Screws, Supporting Frame, Switches.

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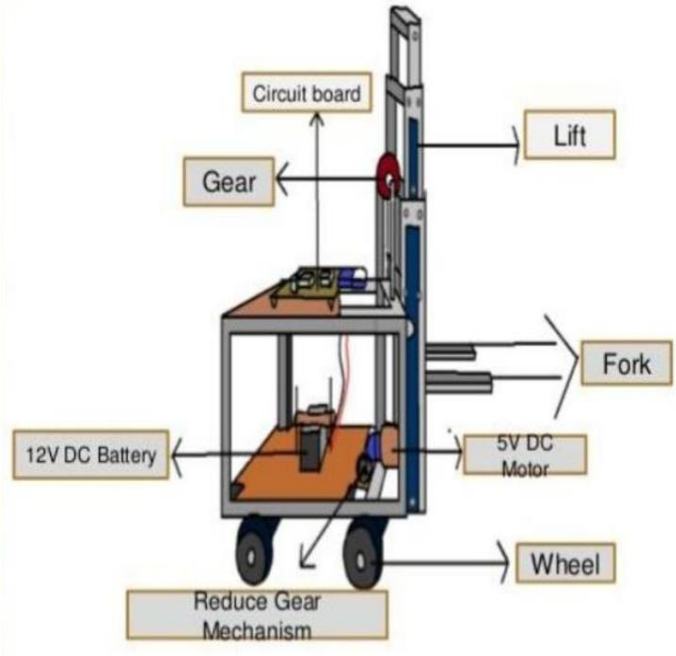

Fig. 3.1. Forklift material handling system

Raspberry Pi as shown in Fig.2.The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside its target market for uses such as robotics. It now is widely used even in research projects, such as for weather monitoring because of its low cost and portability. It does not include peripherals (such as keyboards and mice) or cases. However, some accessories have been included in several official and unofficial bundles. The Raspberry Pi hardware has evolved through several versions that feature variations in the type of the central processing unit, amount of memory capacity, networking support, and peripheral-device support.

Fig. 3. 2. Raspberry Pi

IV. RESULTS AND DISCUSSION

The forklift has been developed with used 4.5V dc motors in which two of them are used for moving the fork lift and other two of them are used for lifting the objects. Dc motors are supplied power with three 12v batteries. In this material handling, system fork such that each fork hand has 30mm length and 7mm width. As a result, it can lift weight of 5 to 7 kg. The system is programmed the forklift such that it can detect the obstacles in its way and warn by the

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proximity sensor. Such that it can avoid collision with the other vehicles and labors in the industry. Although the presence of forklifts in industrial environments is widely recognized as a hazardous situation, there is a definite lack of supportive statistics. The information with a regulatory or guidance overtone. This is consistent with the approach, which assumes the answer to improving forklift safety standards lies in the education/training of the operators. This reliance on training as being the answer to reducing the risks associated forklifts is a low-level control, with only a limited probability of success. Training in conjunction with other administrative controls like improved logistics planning would certainly be an improvement, but where the real gains are to be made will stem from engineering development of the characteristics of the forklift. This would address issues such as stability, proximity and speed control/zoning. Only a multifaceted approach to forklift safety has the potential to influence the broadest spectrum of the market, and make significant improvements in the reduction of forklift related accidents. Given the wide variety of forklifts, of differing configurations, which all behave individually in dynamic environments, recognizing the forklifts stability boundaries is essential in the prevention of roll-overs. Whilst functional diversity is a major strength of the forklift, this doesn't come without inherent risks. The lack of real time information portrayed to the operator, with regard to how a specific task is impacting on the stability of the vehicle and load, contributes to the occurrence of unsafe acts. This may suggest that there is a more effective means to coordinate safe operating instructions than the current load chart attached to the forklift. Consideration of speed limits for specific zones is also a function of logistics planning, which could also be integrated into the vehicles on-board computer much in the way of the proximity system. With the streamlining of the logistics planning process, brought about by the innovation of computer-based 3D modeling, potential trouble spots can be ironed out even before they exist. To ensure that each of the ingredients is factored into the process, the existence of a blueprint for the variety of potential applications would be a beneficial guide. Due to the enormous growth in this area, availability of suitable software packages isn't an issue. It can be expected that the types of functions that these packages perform will also continue to expand over the coming years. So as to achieve improvement in the safety performance of forklifts, significant steps need to be taken by government bodies and manufacturers alike. It may be necessary for bodies to broaden their approach towards forklift safety, so as to promote safety consideration both designs and workplace levels.

V. CONLUSIONS

There is no shortage of statistics corroborating the degree and severity to which forklifts are involved in workplace accidents. This problem is of a global nature and exists throughout all industries revolving around a core of root causal factors. To date most of the research regarding forklift safety has taken an ergonomic, occupational hygiene and training-based approach. Subsequently little advancement has occurred in the way of risk reduction in the form of actual applied interventions. More universal attention needs to be directed towards the issue of forklift stability, so as SAS-like technology is viewed as the norm, rather than an exception. This philosophy should also extend address the quality of the information that operators receive when handling loads. Development of effective stability and load controls for forklifts should occur in manufacturing areas. The array of circumstances where these operator protection devices are effective is immense. Not to mention the 20% predicted reduction in fatalities when these controls are implemented together. Poor logistics planning for forklift operation in factory and warehouse environments spawns a mass of ensuing hazards. The risk of such accidents is further magnified when aisles are obstructed and when the forklift is loaded. Subsequently a need exists to control and alert the forklift to the presence of such potential hazards. An on-board proximity control system, fully integrated with logistics-based speed zoning, would be the most conclusive method of reducing the instance of fatalities occurring as a result of various collisions.

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