AUTOMATIC TROLLEY HUMAN FOLLOWER

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DECLARATION

"I declare that this report "Automatic Trolley Human Follower" is the result of my own research except as cited in the references"

Signature : …….

Author : AMIR HAFIZUL BIN ABD MALEK

Date : …….

"I hereby declare that I have read this report entitled "Automatic Trolley Human Follower" and it fulfills the requirements of the scope and quality for the Bachelor of Electronic Engineering (Industrial Electronic) with Honours"

Signature : ……...
Supervisor's Name : ENGR. NAJMIAH RADIAH BINTI MOHAMAD
Date : ……...

Special dedicate:

To my beloved mother Zainun Binti Ismail and my family for their loves and prayers. To my supervisor and co-supervisor for their guide and give moral support and then to my entire friend for their help and advice.

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ABSTRACT

This project has successfully produced an Automatic Trolley Human Follower for general or industrial user. An automatic trolley human follower is developed to help a user or production industry to reduce the utilization of human energy in order to carry heavy things. This automatic trolley human follower is controlled by a PIC 16F877A microcontroller that can follow the user automatically with integrated circuit of ultrasonic and IR sensor. The 12V DC motor was used as the power supplied to move the trolley automatically follow a user in hypermarket or industrial use. In this project a robotic vehicle is fabricated which runs like a regular trolley by carrying tools from place to another. This is done by using a set of receiver and transmitter ultrasonic sensor to detect a user in a 1 meter range and it will follow the user. Ultrasonic receiver will be placed on the user belt and it transmitter placed in the body of trolley while IR sensor is use to detect an obstacle and completely to trace a user in range 1 meter. The sensitivity of the IR Sensor to detect the blocking object was different based on color. The average distance for bright object detected is 34.7cm while for dark color is 15.2cm. However this trolley has second mode function which can be manually controlled by radio frequency remote control if the automatic was not properly function in the limited space. The Automatic Trolley Human Follower was designed with dimension of sizes 75cm length, 50cm width and 60cm height. The maximum loads that can be carrying by the trolley are 120kg with speed of 13cm/s.

ABSTRAK

Projek ini berjaya menghasilkan sebuah troli pengikut manusia secara automatik untuk kegunaan asas dan kegunaan dalam industri. Troli pengikut manusia secara automatic dihasilkan untuk membantu pengguna dan pihak industri untuk mengurangkan tenaga kerja manusia untuk mengangkat barang berat. Troli ini dikawal oleh PIC 16F877A mikrokontroler yang membolehkan mengikut manusia dengan bantuan ultrasonik dan IR sensor. Oleh itu, dengan menggabungkan ultrasonik dan IR sensor sebagai input dan 12V DC Motor sebagai output yang dikawal oleh mikrokontroller troli itu boleh mengekori pengguna di dalam pasar raya atau dalam industri. Dalam projek ini, kenderaan robotik adalah rekaan yang berjalan seperti troli biasa dengan membawa barang dari satu tempat ke satu tempat yang lain. Ini dilakukan dengan menggunakan satu set penerima dan pemancar sensor ultrasonik untuk mengesan pengguna dalam julat 1 meter dan ia akan mengikut pengguna. Penerima ultrasonik akan diletakkan pada tali pinggang dan pemancar diletak pada troli. IR sensor digunakan untuk mengesan halangan dan mengesan pengguna pada jarak 1 meter. Sensitiviti IR Sensor berbeza mengikut warna objek yang dikenalpasti. Purata jarak objek berwarna cerah yang dikenalpasti oleh IR Sensor adalah 34.7cm dan untuk objek gelap adalah 15.2cm.Walau bagaimanapun troli ini mempunyai fungsi mod kedua yang boleh dikawal secara manual dengan frekuensi radio kawalan jauh jika automatik mod tidak berfungsi dalam ruang yang terhad**.** Dimensi ukuran Automatic Trolley Human Follower adalah panjang 75cm, lebar 50cm dan tinggi 60cm. Beban maksimum yang boleh dibawa oleh troli adalah 120kg dengan kelajuan 13cm/s.

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LIST OF ABBREVIATIONS

DC	-	Direct Current
IC	-	Integrated Circuit
IR	-	Infrared
PIC	-	Peripheral interface controller
PTZ	-	Pant-Tilt-Zoom
RFID	-	Radio Frequency Identification Device
SL	-	Structured Light
UART	-	Universal Asynchronous Receiver/ Transmit

CHAPTER I

INTRODUCTION

1.1 Introduction

Nowadays, most of the things in this world use the technology for more productive life. The people always find something to help them doing a works rather doing them self because of their busy life. However, this new technology which is designed for shopping or carrying heavy thing has never used before. Trolley is a large metal basket or frame on wheels is used for transporting heavy or large items, such as supermarket purchases or luggage at an airport or railway station and transferring a heavy item in industry. By using a trolley, humans do not need to feel bothered and will not get tired for carrying goods although it are quite lot. In manual trolley, human labor is still required to utilize trolley. They still need to push the trolley or bring the basket to bring the stuff. So, if there is a trolley that can be run automatically, then bring the stuff will be easier and efficient.

After making observation and thinking some idea, a decision to build an Automatic Trolley Human Follower for general or industrial user has been make. This Automatic Trolley Human Follower is combination of general trolley with concept human follower robot. Robots can support humans in complex everyday tasks, such as indoor and outdoor navigation and information supplying, or carrying heavy objects [1].The purpose of designing this project is to help shopping management or industry to use this tool as a commitment to improved quality of service and work.

1.2 Problem Statement

From the observation on retail and industrial sector, there is a lot of people in Malaysia are still using manual trolley to carry heavy thing. Most of them do not expose to an automatic trolley technology for replacing existing tools and improve the quality of services. Accordingly, these technologies have been establish to carrying tools that too heavy, that its uses a lot of energy to push the trolley [2].

The innovation of automatic trolley can evade from injury to user because repetitive or sustained awkward posture when handling trolley can cause injury [2]. Furthermore, the manual trolley is not user friendly to pregnant woman and disables people. There was an accident involved uncontrolled trolley which one old woman died in China because of that manual trolley was slides down form an escalator [3].

1.3 Objectives

The main objectives of this project are

i. To design and produce a versatile trolley that is user friendly for human and makes their life more productive.
ii. To produce automatic trolley that can carry a heavy thing to move from one point to another point.

1.4 Scope of Project

This project is focusing a trolley that can be use in hypermarket or industries that automatically follow the user to shopping and carry thing. The versatile design of this trolley can be transform into two versions.

This Automatic Trolley Human Follower target is general user and industry uses. For general user, this trolley are focusing to help a user when they are shopping in hypermarket .The user does not need to worry about the trolley that carry their items and they can focus on their shopping. The trolley can follow the user in specific range and it not follows the user too close.

For the industrial use, the target point is to help industry that need carry heavy tools to move from one point to another point. This trolley can thus reduce the manpower. When their need to carry a heavy tools, it can be handled just by one labor because this trolley can follow the labor. So, It can reduce the cost of workers hired.

The versatile design of trolley can help workers carry up to 100kg of thing. The Automatic Trolley Human Follower was designed using 4 wheel trolleys and focusing on back wheel that connect 12 volt dc motor to move on the trolley. The trolley distance about 0.5 meters from user or obstacle. The process to the overall for this robot is controlled and setting by the PIC 16F877A.

The trolley is also design with manually mode by using Radio Frequency (RF) Remote Control to perform when the automatic mode was broken. There are four buttons to control the movement of the trolley. The button A is for move Forward to The Right, button B is for Backward Right, C for Forward Left and D for Backward Left.

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION

By design the suitable Automatic Trolley Human Follower for the applications that desired, the decision has been made from a combination of some robots follower that has nowadays with a manual trolley that existing. These are some robots followers that have a guideline to design the Automatic Trolley Human Follower.

2.1.1 Radio Frequency based Remote Operated SPY Robot

T. Krishnan et al. were creating a Radio Frequency based Remote Operated SPY Robot. It is a remote operated spy robot circuit which can be controlled by using a wireless remote controller. It can capture audio and video information's from the surroundings and can be sent to a remote station through RF signals [4]. This robot was creating to spy and capture audio but the concept of RF Remote Controller can be used to the Automatic Human Following Robot. Figure 2.1 was show the Radio Frequency based Remote Operated SPY Robot.

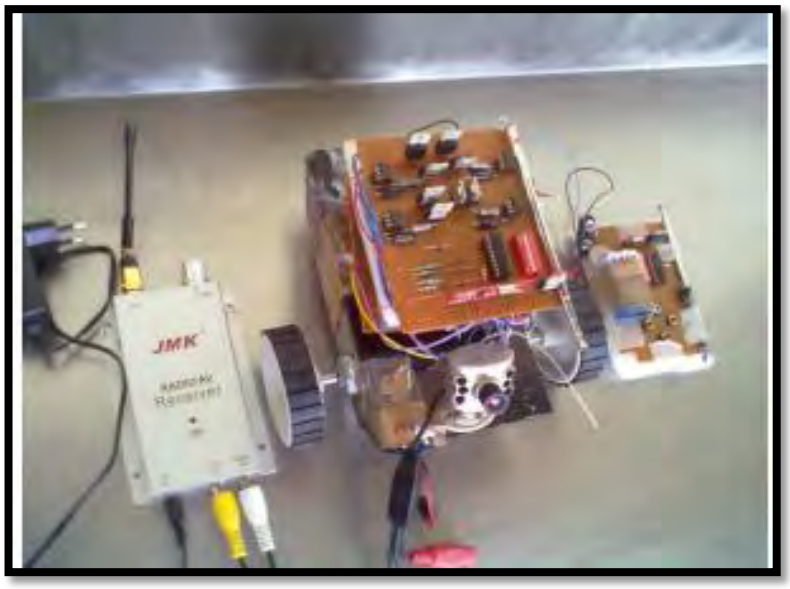

Figure 2.1: Radio Frequency based Remote Operated SPY Robot

2.1.2 A Mini Forklift Robot

S. Liawatimena et al. was present the design of a mini forklift robot that can store and pick up object to/ from specified storage slot from/ to a based using line follower and RFID. Currently, in warehouse storage system are mainly still done in a traditional way using human operator to store and pick goods into specified location. This project is intended to construct an autonomous mini forklift robot that using Radio Frequency Identification Device (RFID) technology to find the coordinates of targeted storage slot and goods identification. The control of movement consists of DC Motor with Pulse Width Modulation and Infrared sensor for the line follower [5]. However, the cost of RFID is expansive because it is complex technology. Figure 2.2 show the design of forklift Robot.

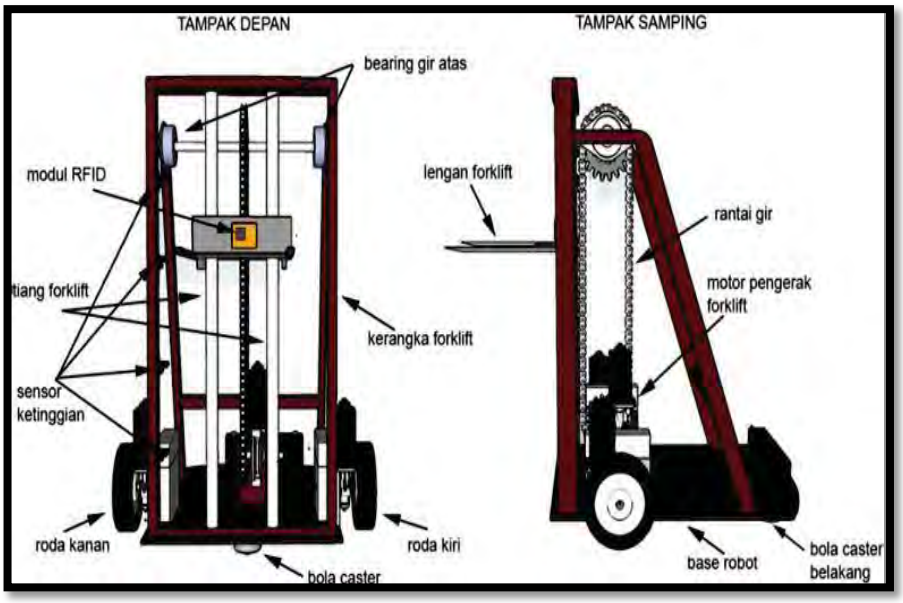

Figure 2.2: Design of Forklift Robot

2.1.3 Human Leader and Robot Follower Team

Based Johann Borenstein et al. was performed several experiments, in which the leader follower team moved along a very challenging path of mostly curving streets, some of which with steep slopes. Experiments took between 9-15 minutes each. The follower always used its onboard sensor to identify and track the leader except when line-of-sight was briefly interrupted after the leader turned around a corner. The follower's distance to the leader was always short, fluctuating between 0.5-2.0 m. As a result, direct line-of -sight outages were usually very short on the order of 1-3 seconds [6].It used direct line-of-sight-based sensor that not suitable when a user being around a corner. Figure 2.3 was show the Human Leader and Robot Follower Concept.

Figure 2.3: Human Leader and Robot Follower concept

2.1.4 Infrared Sensor Based Target Following Device for a Mobile Robot

Based Youg Jen Wen et al. was report the sensory setup and algorithm for target following on the mobile robot. The direction detection of the target is achieved by the setup of nine IR receivers which monitor the signals from the transmitter installed on the target [7].A IR sensor is not accurate compare to the ultrasonic sensor. Figure 2.4 was show the IR Sensor range.

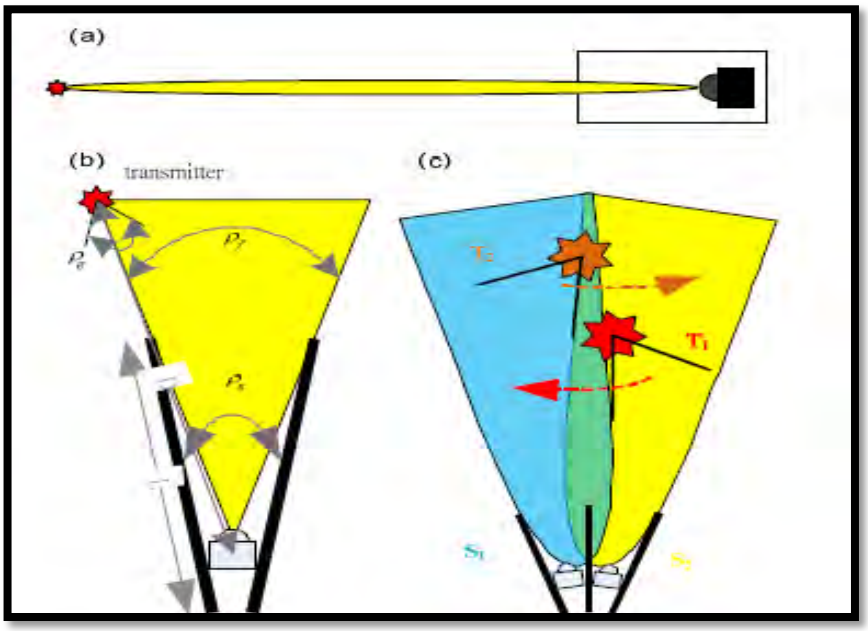

Figure 2.4: IR Sensor Range

2.1.5 Detecting and Tracking People by Mobile Robot Using Structured Light Range Sensor

In Young jinn Hong et al. was introduced a home robot to keep track of moving people in home environments. A SL range sensor is utilized in light of its high commercial viability. The sensors typically have relatively short measurement range and poor range resolution at a long distance (within 4 meters in our case). These shortcomings raise some problems that feature detection process gives many human legs candidates making it difficult to discriminate the real human legs from other patterns [8].The sensors typically have relatively short measurement range and poor range resolution at a long distance. Figure 2.5 show the Mobile Robot Using Structured Light Range Sensor.

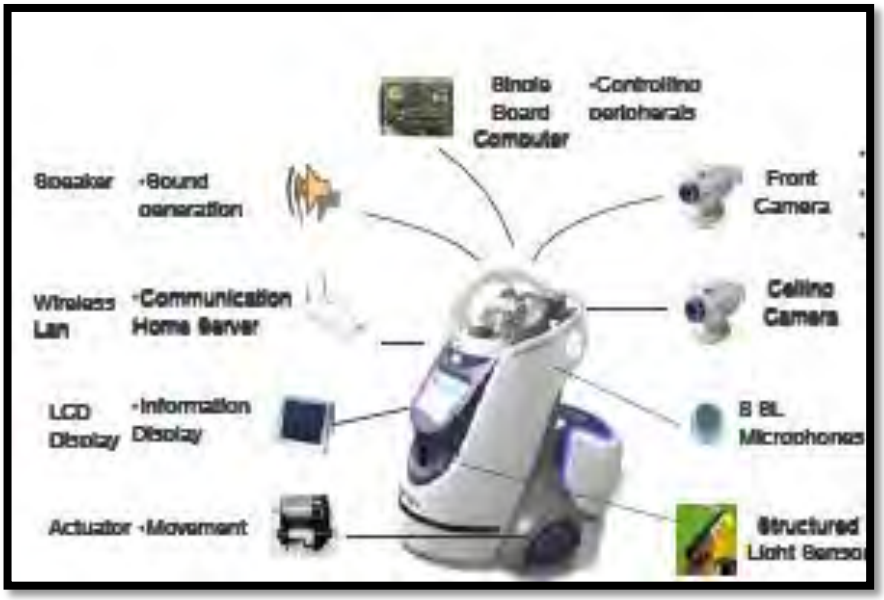

Figure 2.5: Mobile Robot Using Structured Light Range Sensor

2.1.6 Robot Tracking Using Vision and Laser Sensor

Wen Dai et al. was presents a real-time person tracking system for a mobile robot using the information from a PTZ video camera and a laser range finder. The model includes the color, edge and size information of the tracked person. People moving in the field of view are detected by the robot via the laser range finder and verified against the target person model using the images captured by onboard camera. A practical filter is used to estimate the position and the velocity of moving target person for controlling the robot to follow the target [9].However, the laser sensor can only detect in straight position. So, the range of the detected is small. Figure 2.6 was show the Robot Tracking Following a Person.

Figure 2.6: Robot Tracking Following a Person

CHAPTER III

METHODOLOGY

3.1 Introduction

There are four parts in this methodology process. First, the illustration of project design that show dimension of vehicle frame. Second, it is about the overview of the project development. Third, the project operation which is consist a manual and automatic mode. Fourth, the circuit design, that show a module design that are used in the making of this project.

3.2 Illustration of Project Design

This trolley frame has been designed by using some material, such as iron frame, and four wheels. The figure 3.1 shows the dimension of the vehicle frame for length, width and height. The frame that has been design has 75 cm length, 50 cm width and 60 cm height. . The figure 3.1 also shows the placement of IR sensor, Ultrasonic sensor and main circuit box.

By designing this vehicle frame, it is been considered to versatile trolley that can be used for different field such industry or to carrying a big tools that surely does not fit into basket.