INTELLIGENT SUMO ROBOT (SUMOBOT)

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This report is submitted in partial fulfilment of the requirement for the Bachelor in Computer Science (Artificial Intelligence).

FACULTY OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2015

DECLARATION

I hereby declare that this project report entitled

INTELLIGENT SUMO ROBOT (SUMOBOT)

is written by me and is my own effort and that no part has been plagiarized without citations.

STUDENT: _____ Date:

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SUPERVISOR: _____ Date:

(DR.ABDUL SYUKOR BIN MOHAMAD JAYA)

DEDICATION

To my mother and father,

Roslina Bt. Ma'sah and Mohamad Rahim B. Abdullah.

To my supervisor,

Dr. Abdul Syukor Bin Mohamad Jaya.

To my friends and colleagues and all that support me always.

Who inspired me with their love of learning, supporting, and teaching.

ACKNOWLEDGEMENT

As a matter of first importance, I appreciative to Allah the Almighty God for gift, giving to me to finish this task. I also want to amplify my appreciation to my supervisor, Encik Abdul Syukor Bin Mohamad Jaya as bolster, showing and helping me to this undertaking. Extraordinary thanks likewise committed to him for all remarks, thought and a rules from first day I began this venture.

This thankfulness likewise goes to my companion that dependably gives bolster, suppositions and advices for additional to finish this task. Not neglected to the technician of A.I 4 Lab at FTMK, that invest me some time about the robot information for finishing this venture.

Particularly to my cherished family, I might want to forward my obliged to them for their consistent support during my study period, their understanding and kindness. In conclusion, I might want to thank to everybody who has contributed to my Projek Sarjana Muda. Your consideration and collaboration in consummation of my paper work always being appreciate.

THANK YOU

ABSTRACT

In this report the development of an Intelligent Sumo Robot is presented. The issue in the development of this project is to build a robot that able to win a simulate Sumo Robot competition by planning a winning strategy autonomously. The Intelligent Sumo Robot controller consist of three input and two output system. The inputs are the measurement of distance by using the ultrasonic sensor to the opponent, the measurement of light by using light sensor and the input by the touch sensor. The output are the speeds of the wheels. In order to achieve the intelligent ability of this robot, a fuzzy logic controller (FLC) is used. The robot is driven by two independent servo motor. One light sensor, one touch sensor and one ultrasonic sensor embedded to the robot to gain information from the environment. The fuzzy logic controller (FLC) is used to produce the output which is the speed of the wheels. By taking the measurement of the distance, light and touch sensor value, the speed of the wheels will be determine. Based on the testing and final result which is 90% of success achievement. This project is considered as achieved the objective of this project development. In the future, the robot intelligent can be increased by using more precise sensor to increase the reading of the input and other A.I technique to produce a more intelligent robot.

ABSTRAK

Dalam laporan ini pembangunan sebuah Robot Sumo Pintar dibentangkan. Isu dalam pembangunan projek ini adalah untuk membina sebuah robot yang mampu memenangi sebuah simulasi pertandingan Robot Sumo dengan merancang strategi kemenangan secara autonomi. Pengawal tindakan Robot Sumo Pintar terdiri daripada sistem tiga input dan dua output. Input yang diperolehi oleh robot ini adalah ukuran jarak dengan menggunakan sensor ultrasonik kepada pihak lawan, pengukuran cahaya dengan menggunakan sensor cahaya dan input sentuh dengan sensor sentuh. Output adalah kelajuan roda. Dalam usaha untuk mencapai keupayaan pintar robot ini, sistem kawalan logic kabur digunakan. Robot ini digerakkan oleh dua motor servo. Satu sensor cahaya, satu sensor sentuh dan satu sensor ultrasonik digunakan oleh robot untuk mendapatkan maklumat dari persekitaran. Sistem kawalan logik kabur digunakan untuk menghasilkan output yang merupakan kelajuan roda. Dengan mengambil ukuran jarak, cahaya dan nilai sensor sentuhan, kelajuan roda akan ditentukan. Berdasarkan ujian dan keputusan akhir, projek ini telah mencapai kejayaan sebanyak 90% . Oleh itu, projek ini dianggap sebagai telah mencapai objektif pembangunan projek ini. Pada masa akan datang, robot ini boleh ditingkatkan kepintarannya dengan menggunakan sensor yang lebih tepat untuk meningkatkan bacaan input dan teknik AI lain untuk menghasilkan robot yang lebih pintar.

TABLE OF CONTENTS

LIST OF TABLES.

LIST OF FIGURES.

CHAPTER I

INTRODUCTION

1.1 Project Background.

Autonomous robot are mechanical devices that are able to move and make their own decision by itself. The autonomous ability achieved via the availability of exterior sensors that able to receive information from the environment through distance measurement, visual images and proximity measurement. The most common sensors are distance sensors (ultrasonic, laser, etc.) capable to measure the distance to the opponent and detecting the opponent. When this ability used by the Intelligent Sumo Robot to detect the opponent, it should be able to win the competition by push the opponent out of the ring of the Sumo Robot competition.

In attempt to build an autonomous robot, researchers always faced with the necessity of build a complex system that are difficult to control or a simplified system which are not sufficient to represent the real world.

The options that involves complex system are less interesting due to lack of analytical method to handle the uncertainty and concisely represent the knowledge in a practical control system. Non-analytical method such as fuzzy logic, neural-network and evolutionary computation have shown the ability for an intelligent control of complex system. In particular, the fuzzy logic has proven for handling the world uncertainty and knowledge representation.

1.2 Problem statement.

Robot that are available right now mostly of it did not embedded with the intelligent technique required to win the competition. To win a competition, the robot should have a strategy on how to defeat the opponent. The traditional game also should go through modernization to make the game interactively, attractively and also available on the modern devices.

In order to fulfill the requirement of intelligent, strategy and game modernization which are lead to the issues of robot development cost and market availability, an intelligent SUMO robot (SUMOBOT) is developed in this PSM project. The robot should be embedded with tactical strategy and intelligent technique to win the SUMO game.

1.3 Objective.

The objectives of the Intelligent SUMOBOT are listed as below:

i. To develop a robot can move forward, backward and turn around in sumo game.

ii. To fix the robot with the suitable sensor to accomplish tasks in sumo game.

iii. To embed the sumo robot with intelligent technique to plan a winning strategy during the game.

1.4 Scope.

The Intelligent SUMO robot should be able to detect opponent and defeat it while still stay in the ring.

1.5 Contribution.

The Intelligent Sumo Robot is developed in hoped that it can modernize the traditional game of Sumo to a new level by implementing the A.I technique in order for the robot to plan a strategy to win a simulate Sumo Robot competition. By introducing the A.I technique to the robot, it is hoped that many people will gain interest to study in this field deeper.

The interest of people in joining the Sumo Robot competition also hoped to increase by developing this project. Furthermore, Sumo is a tradition of Japanese people that should be preserve for the next generation.

1.6 Expected output.

i. Able to develop a robot that can move forward,backward and turn around in a sumo simulated game.

ii. Able to fix the robot with suitable sensor in order to accomplish tasks in sumo simulated game.

iii. Able to embed the robot with intelligent technique to plan a winning strategy during the game.

1.7 Conclusion.

The Intelligent SUMOBOT is built for the Projek Sarjana Muda (PSM).This chapter explained the problem statement, project objective, project scope, contribution aspect and lastly the expected output for this project.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction.

This chapter will explain about the overview of the robotic in various area and type of robot and will focus on the robotic in competition area where the Intelligent Sumo Robot will be involved.

2.2 History.

The history of robotics is unite and connected specifically with the histories of innovation, science and the fundamental rule of advancement. Considered as a major aspect of robotics, innovation of processing, power, even pneumatics and pressure all can be considered as a feature of robotics history. In 1920, Karel Capek was played title Rassum's Universal Robot (RUR) where the word robot was initially instituted by the Czech writer (Noviny. L, 1933).Currently, robotics speak to one of the best endeavour humanity have been made to create a counterfeit, aware being. In antiquated time, the Egyptians and Greeks constructed mechanical robots to perform straightforward errand to facilitate their everyday life.

2.3 Types of robot.

There are numerous sorts of robots that were manufactured for different reason, for example, legged, wheeled, controller, self-sufficient and unmanned aeronautical vehicle robots. A robot is characterize as a reprogrammable, multifunctional controller outline to move material, apparatuses, parts or particular gadgets through variable system movements to perform an assortment errands (America, 1979).A robot can be self-sufficient or semi-self-ruling. It likewise can go from humanoid to mechanical robot. At right on time when the robot is delivered, the vast majority of it is created keeping in mind the end goal to supplant the human workers in risky, exhausting, or generally unsafe assembling undertakings (Akins, 2013).Robots have been rebuked for the ascent in unemployment as a result of the utilization of robots to supplanted human (Hoy, 2014).

2.3.1 Legged robot.

Legged robot are sorted as one of the versatile robot. The vast majority of the robot that are assemble have 4 or 6 legs to give the robot soundness that the robot need. Legs were utilized as it is seen to have the capacity altogether territory reason. Legs are use over wheels seeing as legs are more successful in an uneven domain than wheels (Wikipedia, 2015).One sample outline for legged robot is hexapod robot. It is suitable for physical and space applications, and they can incorporate elements, for example, variable geometry, great steadiness, access to differing landscape, deficiency tolerant movement, and omnidirectional movement (Chàvez-Clemente, 2011).By utilizing the wheel or crawlers, there are exist some confinement, for example, the wheel or crawlers just ready to climb a large portion of the extent of the breadth of the

wheel. Conversely, the utilization of legged robots can overcome impediment that are similar to the span of the machine leg (Carbone & Ceccarelli, 2005).

2.3.2 Wheeled robot.

Wheeled robot are likewise sorted as one of the portable robot. Wheel Mobile Robot(WMR) are quickly expanding in apply autonomy administrations and mechanical, particularly when the robots expected to perform adaptable movement capacity on ground or smooth surfaces (Schraft R D, 1998).Majority of wheeled robots use differential directing which will utilize independently determined wheels when the robots moved. To keep up the robots equalization, extra tire extra wheels are utilized. These additional wheels are not determined by engine (Wikibooks, 2011).There are a couple sorts of versatility configurations (multi or single body vehicle structure, activation, area, wheel number and sort) can be utilized as a part of the applications (Jones J L, 1993).Omni Wheels is a possibility for wheeled robots with wheels that are not all mounted on the same hub. An Omni Wheel in view of numerous littler wheels that are making up a vast one. The littler one have hub opposite to the hub of the centre wheel. By utilizing Omni Wheel, the robots can move in two headings and holonomic associate which implies the robots can immediately move to any course.

2.3.3 Manipulator robot.

Manipulator robot in robotics is a gadget that is utilized to control an item with no immediate contact included. In ahead of schedule time, the manipulator robot were

utilized to handle material that are radioactive or bio perilous. In a place that can't be gotten to, automated arms were utilized. A mechanical arm is a sample of manipulator robot that is programmable to act simply like a human arm. Joints were utilized to join the controller permitting either rotational movement or translational relocation (Craig R. Carignan, 2002).The configuration of the end-effector or the automated hand can be planned so any longing assignment, for example, getting, penetrating, welding and so on., can be perform contingent upon the reason for the robot. In a couple of circumstances, the need to perform close copying like the human hand is required as the robots will lead transfer and bomb demilitarization (Lab, 2012).The Space Shuttle Remote Manipulator System otherwise called Canadarm or SSRMS and its inheritor Canadarm2 are a couple of illustrations of multi-level of flexibility mechanical technology arms that have been utilized as a part of the space transport for different errands. The Curiosity meanderer that are being utilized to investigate the scratches additionally have an automated arm to help the robot grabbing question on the scratches for test (JPL.NASA, 2012).

2.3.4 Autonomous robot.

An autonomous robot is a robot that perform it tasks and behaviour with high ability of autonomy. The ability of a robot to perform autonomously are highly required in several fields such as cleaning the floor, water waste management, delivery, space exploration, and self-services. Autonomous robot need several sensor to make sure the robot able to perform it task and avoid involving in any trouble.

2.3.5 Unmanned Aerial Vehicle (UAV).

An Unmanned Aerial Vehicle (UAV) is an aircraft without a pilot. The word Drone stands for Dynamic Remotely Operated Navigation Equipment. The flight of the UAV is either controlled by remote control of a pilot standing on the ground or by the computer autonomously. The most early attempt to build unmanned aerial vehicle was A.M. Low's "Aerial Target "of 1916.The build of U.S.UAV began when the officer of the United States Air Force concerned about the loss of life of the pilot during wartime. U.S Navy initiated the America's highly classified UAVs on August 2&4 into the first combat mission in Vietnam War (William, 1982).UAV also a system. Rustom is an example of UAV. It is a Medium Altitude Long Endurance UAV developed by DRDO. Apparently, the UAV will never get to replace manned aircraft fully. To wholly replace the manned aircraft, it would be technically risky and expensive. The continuing trend where the electronic miniaturization, the cost of UAV become cheaper and the size of UAV become smaller. There are a few field where the UAV can be applied such as in counter terrorism, transport, search and rescue (Fung, 2013), scientific research, and armed attack (Sauer, 2012).

2.3.6 Humanoid robot.

A humanoid robot is any robot that have appearances resemble the other alike a human. The term have been utilized and show up as a part of the interpretation of a sci-fi novel on 1867.The utilization of the term have been regular in science in 20th century (Puech, 2015).ASIMO is an acronym for Advanced Step in Innovative Mobility (Kornblum, 2000).ASIMO was constructed to have the capacity to work at certifiable situations. Since 1980's, Honda started to build up a robot that carbon copy a human which ready to work, walk, adjust and associate in human circumstance. The