MOBILE ROBOT SURVEILLANCE SYSTEM WITH GPS TRACKING

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For all the future engineering students, my family members, supervisor and friends.

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ABSTRACT

The main purpose of this project is to design and assemble a mobile robot system that has the ability to be autonomous-controlled and on the same time, allows itself to be tracked its location and position. The robot has the ability to move as per the line that will design its route path and also has the ability to move in fixed route. Besides the robot, another major part of the project; the Global Positioning System (GPS) tracking application is also considered as a crucial application in the project. Through this GPS tracking application, the position of the robot, which will be attached a GPS module will be determined and its location will be transmitted back to the remote terminal of the workstation. Together with all these systems, there is also another monitoring system which will provide a live video feed back to the work station. This monitoring system will also be connected to the robot for monitoring purpose and later transmits its signal back to the workstation. The GPS position transmission signal and the live video feed signal will be transmitted via wireless communication methods. As for the robot motion, the infrared sensor (IR sensor) will be used to determine the line path.

ABSTRAK

Tujuan utama projek ini adalah bagi mereka-bentuk dan memasang sistem robot mudah alih yang mempunyai keupayaan pergerakan tersendiri dan pada masa yang sama, boleh mengesan lokasi dan kedudukan robot tersebut. Robot ini mempunyai keupayaan untuk bergerak dalam satu baris serta mempunyai keupayaan untuk bergerak dalam laluan tetap. Selain robot, ada satu lagi bahagian utama projek tersebut; iaitu Global Positioning System (GPS) yang akan mengesan kedudukan robot serta dianggap satu aplikasi yang penting dalam projek ini. Melalui penjejakan GPS ini, kedudukan robot akan ditentukan dan lokasi yang akan dihantar kembali ke terminal yang jauh dari stesen kerja, menggunakan modul GPS tersebut. Bersama-sama dengan semua sistem ini, terdapat juga sistem pemantauan kamera yang akan memberi suapan video secara langsung semula ke stesen kerja. Kedudukan lokasi robot yang melakukan penghantaran isyarat serta isyarat video secara langsung akan dihantar melalui kaedah komunikasi tanpa wayar. Bagi pergerakan robot, pengesan inframerah (IR sensor) akan digunakan untuk menentukan laluan robot tersebut.

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CHAPTER I

INTRODUCTION

In this chapter the overview introduction regarding the project will be discussed and briefed. The project is developed as a requisite for the surveillance, monitoring and positioning purpose in variety of field such as monitoring a venue under a controlled and limited motion, safety surveillance and many other fields requiring the similar service.

1.1 Project Introduction

The project Mobile Robot Surveillance System with GPS Tracking consists of GPS application, autonomous movement control and live video feed for surveillance purpose. Through the device, the position of preferred equipment; such as vehicle and robot can be located in GPS coordinate mode. The live video feed surveillance part established using wireless technology based camera or high quality wireless technology based camera. As for the GPS locating system, the data will be transmitted using wireless transmission mediums; in this project, Bluetooth module. This project is suitable to be implemented in various places or situations that require monitoring and surveillance, particularly at any event of mishaps and disaster. Besides that, this projects technology has the potential for hefty growth in monitoring technologies.

1.2 Project Objectives

The main objective of the project is to develop a mobile robot with the purpose to serve as monitoring system for variety of uses such as observation and guarding tasks and assessing a venue that is hazard for human entries. Variety of basis has been identified suitable to adapt the project, monitoring areas that is not suitable for human appearance, a large environment that need to be surveyed and also monitor places that the condition is hazardous to humans. The developed project will consist of:

(a) Robot that have a fixed and auto-determining route with the user having priority for the robots' movement determination.

The developed project has the ability to detect line and move in a fixed path though the path is either curvy or straight. The movement also will be determined by the users as the line will be setup by the users themselves. This could be done by using the IR sensor as it will detect the line and as it is a stationary type, thus will transmit in a single position.

(b) On-board camera to provide live video feed.

The on-board camera is the crucial and considered most important surveillance medium on the project as the user will be able to monitor the on-location views only through the camera system. This video feed will be sent to the workstation through wireless transmission as well.

(c) On-board GPS receiver for location and positioning purposes.

To optimize the surveillance system based project, GPS receiver module will be placed on the mobile robot and the GPS coordinate obtained will be transmitted back to the workstation. This GPS system boosts the projects functionality and increases the functional scope of the mobile robot as this enables the robot exact location identifiable.

1.3 Problem Statement

Presently, the needs for monitoring and surveying missions are extremely high in demand due to devastations and accidents that are happening quite frequently nowadays. Places those are not suitable for human presence and access often creates high risk together with endangering the human life as well. Border patrolling, chemical plantations, nuclear reactors and other life risking places are part of the mentioned condition. Furthermore, the existing patrolling and monitoring robots and equipment that are already being used are high in price and require complex circuitries that often results delayed operation in the event of break down. Besides that, robot that can be used for domestic purposes; small scale monitoring and surveillance in a smaller radius site such as house and safe lockers in banks, emphasizing on cheaper prices, simple and understandable operative system are extremely rare and need a huge attention as it will be new to the domestic surveillance market.

1.4 Scope of Project

In order to succeed the project, a few scopes have been identified to be associated with the project. Among the scopes are:

(a) Easy-to-built design using hardware and software based appliance.

The hardware part includes the components on the robot, the wireless webcam, workstation (PC) and the signal transmitters. As for the software part, few software associating with the project has been identified such as Visual Basic and C language related software including the editor and the hex converter software.

(b) Easy operation of the project.

The project will be designed to be user friendly and only few procedures will be involved in operating and controlling it. Surveillance and the autonomous motion control plays important role in the procedures, thus the robot movement will be easy to be predicted by the user and even designed by the user themselves during the line determining and designing. Autonomous system emphasizes on the simplifying and eases the users' task.

(c) Used for effective and advanced surveillance.

The major function of the robot will be the surveillance and GPS positioning indicator. Using this system, an exact location of the robot can be positioned thus the surveillance system will be effective.

(d) Small, compact and interactive design.

To enter space constrained situation, the robot is extremely suitable due to the nature of its size and design. Places that are hard to be reached, jeopardizing the safety of possible rescuers and also hazardous internal contents could be monitored using the robot, thanks to its design.

1.5 Methodological Review

As for the project methodological overview, a brief method or approach will be discussed. Generally, there are six (6) approaches identified in order to precede the project successfully. These six steps consequently develop easy planning and action implementation on the project execution flow. The referred six steps are:

(a) Study and research project case.
(b) Simulation design.
(c) Hardware development.
(d) Software development.
(e) Circuit functionality testing and troubleshooting.
(f) Final assembly and completion.

These steps each has their own methods of proceedings and will further be elaborated in the methodology chapter in this report with further details and proper project execution flow chart.

1.6 Report Structure

The Mobile Robot Surveillance System with GPS Tracking project will be reported completely in this project report, right from its introduction, planning, layout, designs, and implementation methods up to desired outcome on the final stage. In order to compile the proper project execution in a standardized structure, thus the report was equipped with several chapters and sub topics that will provide easy access for the individual that will further research on the project through this report according to the available chapters and contents consequently.

In chapter I, there few sub-sections such as project introduction, objectives of the project, problem statement, scope of project and methodological overview. Basically, this chapter serves as the introduction chapter that allows reader to have a general idea on what the project is about and the scope that the project is designed to fill up based on the given problem statement.

Chapter II consists of discussion regarding the literature review that relates the project with theory and concept through the available model and diagram. A brief explanation on perspective and method used in precious research also will be discussed with emphasizing how current project is related with the researched project. On top of that, this chapter relates the objectives positions and problem statement in wider research world with the theory and concept used to solve problem in project. Hypothesis; assumption on starting point of an investigation or research related to the methodology also will be defined clearly in this chapter.

As for the chapter III, a step by step procedure such as data collection, data processing and detailed processing of data, models, flow charts and also other form of researches for the Mobile Robot Surveillance System with GPS Tracking was discussed. As for the selection of the proper method in the approach of the project, the necessary factors were identified and its advantages also analysed in order to set a proper methodological guideline in the project execution.

The final section of the report, reference and attachment, will display the necessary attachments and references used in the project.

CHAPTER II

LITERATURE REVIEW

Literature review of this report will be covering some important details, theories and perspectives that will further induce the advancement of this project on fulfilling the objectives as stated earlier on the report. In this section, there will be several organised sub-chapters such as theories related to project, concepts of previous researches related to Mobile Robot Surveillance System with GPS Tracking, project outcome with major components involved and finalised mobile robot circuitry. Through all these compiled details in the report, subsequently a full-fledged report consisting accurate, detailed, factual and trusted facts regarding the project produced.

2.1 Theories Related To Project

In the Mobile Robot Surveillance System with GPS Tracking project, there are several theories needed to be given heavy importance as the theories related may form the very basis of the applications related to the project. Several theories has been identified that will be the very basis of the project such as Global Positioning System (GPS), wireless transmissions such as Bluetooth transmission module, Infrared sensor and also surveillance systems in the context of security, situation monitoring and also surveying purpose.

2.1.1 Global Positioning System (GPS)

Global Positioning System (GPS) is one of a technology that is gradually changing the method daily activities are being conducted. We can use GPS technology while we are doing our daily household chore and also outdoor activities such as exercise, driving, fishing and so on. With a GPS receiver, a large amount of information can be achieved and accessed easily at our fingertips. Few examples of how GPS technologies are being used are:

(a) Identify exactly our jogging distance and our speed while tracking our path so that our way back home easily determined.
(b) Identify the perfect place to do fishing-activities on a lake and relocate without difficulty.
(c) Get to the nearby urbanized location when we are out-of-town.
(d) Discover the nearby airports besides identifying the aerospace conditions that will be used.

The Global Positioning System (GPS) uses satellite-dependent navigation system that transmits-receives (dual way) signals such as radio signals. GPS receiver usually provides the information based on the obtained GPS-signals. Via GPS technology, we can determine location, velocity and time, for 24 hours/day and also no matter what weather condition a place is affected with, accessible from any corner of the world. Basically, a GPS receiver determines four variables: longitude, latitude, height and time. Extra information such as speed, direction and so on can be extracted from these four components. If one knows the technical background of the GPS system, then it becomes possible to extend and use new positioning and navigational devices. [9]

GPS, which used to be recognized as the NAVSTAR (Navigation Satellite Timing and Ranging), was established initially for the army usage. Due to triangulation abilities and accessibility using miniature, inexpensive machineries, the government allows the civilians to use the service as well. The USA has possession of the GPS satellite controlling technology. USA's Department of Defence is in charge of maintaining it. The civil signal Standard Positioning Service (SPS) is