RESEARCH ARTICLE   OPEN ACCESS

Mobile Robot Movement Based on Global Positioning System

Fitria Tri Hastuti*
*(Electrical Engineering Department, Tun Hussein Onn Malaysia University, Malaysia
Email: fitria.tri.h@gmail.com)

--------------------------------------*************************--------------------------------

Abstract:
Dealing with job that can give bad impact life is something that human is avoided to do. Human need something that can do the job without impacting to human life. Rescuing people from a fire or explore a place with high chemical pollutant is some example of job field that can impact into human life. Building a robot to do job what human are resisted to it is solution for kind of problems above.Building a robot to do job what human are resisted to it is solution for kind of problems above. Autonomous in navigation is a key for a robot to move independently from one place to another. By using GPS module receiver, the information about a coordinate of a location can be obtained. Arduino microcontroller will be used as the brain of the system. The two way of communication with the smartphone is established by using GSM module as the interfacing hardware. Microcontroller will send the current location to Smartphone.

Keywords —**GPS, GSM, Microcontroller, autonomous navigation.**
--------------------------------------*************************--------------------------------

I. INTRODUCTION

Dangerous environment is an example of a place where human is resisted to enter it. But there are many things that human need to enter it, for example monitoring of certain pollutant [1][2] or fighting in firing building.

Robot needs to independently in reaching the destination that it needs to attend to. A destination has its coordinate of location and a GPS module will receive the information of the location coordinate.

The current location of the mobile robot needs to send to the user so the user can monitor for the position of the mobile robot to check if it is coming along into the right path. Many methods is developed to handle the stability of the robot, start from adding an ultrasonic sensor as an obstacle avoidance[3] or adding it with an integrated camera for full comprehensive obstacle avoidance handling[4].Algorithm for mobile robots for decision making is a huge challenge and an innovative topic for researchers.The Fuzzy Logic Algorithm [5] and Path Planning Algorithm [6] are one of the example.

II. METHODOLOGY

A. Data Acquisition

The coordinate of places will be acquired using the GPS sensor. It will be tested in many different locations. The data acquired will be compared with data acquired from smartphone application for reliability of the GPS sensor data.

B. Block Diagram

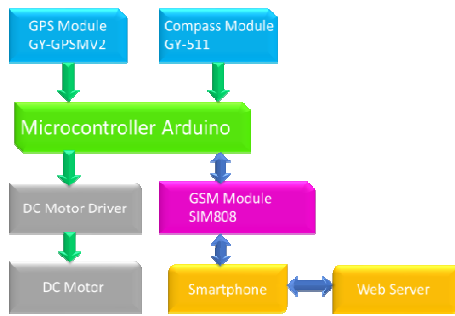Block diagram of the system is described as below:

Fig.1. Block Diagram of the system

A GPS sensor will receive the satellites signal. This signal contain data for location coordinate such as longitude and latitude. This data will be sent to Microcontroller Arduino Uno. By adding TinyGPSplus library in the IDE Arduino library, the calculation to retrieve the latitude and longitude from GPS sensor can be obtained.

C. Software

Arduino IDE 1.8.13 is used to program the microcontroller Arduino Uno. This software is an open source software.

D. Hardware

1) Microcontroller Arduino Uno

Microcontroller Arduino Uno is based on the ATmega328P. The board has 14 digital input or output. In this 14 digital I/O, 6 of it can be used as PWM output. The Microcontroller Arduino Uno is simply can be connected to the computer via an USB cable.

Fig.2. MicrocontrollerArduino Uno

2) GPS Module

A GPS Module is used as a GPS receiver. The GPS receiver module receive the signal from the GPS satellites and the GPS receiver will give the

coordinate of the location in National Marine Electronics Association (NMEA) Standard[7][8][9][10]

.
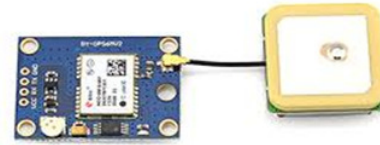
Fig.3. GPS Sensor Module GY-GPSMV2

3) GSM Module

The GSM module is used to interface the communication between arduino and the Smartphone device [11]. The GSM/GPRS module will send the information of the current mobile robot location by using TCP/IP connection through the GSM/GPRS Network with an exact Universal Time Coordinated Time (UTC) [12][13]. SIM808 is used for the GPS Module.

Fig.4 SIM808 Module

4) Compass Sensor

A compass sensor is needed to help the mobile robot heading into the right angle for destination location.

Fig.5 Compass Sensor GY-511

5) Smartphone

Smartphone has development in many years. Today, Smartphone can receive a SMS and also can open a browser. The message that is received from Microcontroller Arduino Uno has a coordinate location in it. By using a browser of Google Map

Application, the position of the module can be displayed on the Smartphone.

III. RESULT AND DISCUSSION

A. *Data Acquisition*

Data of location coordinate in many different places are acquired by placing the agent in different places. One place is chosen as zero position, and recorded the coordinate location of this zero position. The agent will be moved from zero position about 3 meters away until about 18 meter away from zero position. The latitude and longitude of these different places will be recorded. By using the serial monitor in Arduino Uno Tools, the latitude and longitude of the zero position can be presented. Here is the coordinate location of the zero position.

Fig.6. Serial Monitor on the zero position.

The agent is moved into different places and the location coordinate is obtained by the GPS Sensor Module. The location coordinate data of the agent on the different places are presented in this table 1.

TABLE I

Location coordinate data of the agent on different places retrieved from GPS sensor module.

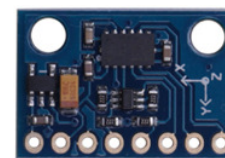| POSITION	LATITUDE	LONGITUDE
Zero	1.04541	104.04848
3 meter	1.04541	104.04834
6 meter	1.04530	104.04830
9 meter	1.04533	104.04831
12 meter	1.04538	104.04826
15 meter	1.04543	104.04827
18 meter	1.04545	104.04821
21 meter	1.04552	104.04816

IV. CONCLUSSION

An autonomous navigation for mobile robot is build in this project. The logic algorithm is used as the obstacle avoidance algorithm in order to help the mobile robot reach the destination location.

V. FUTURE SCOPE

The scope of future work in this autonomous navigation project is increasing the accuracy of the receiver's GPS sensor in order to obtain more accurate coordinate positions especially in locations such as mountains and valleys where the GPS signal at these locations is less accurate and also how to increase the effectiveness in avoiding obstacles.

ACKNOWLEDMENT

REFERENCES

[1] A. Azhari, W. Wan Zaki, N. Zinal, B. Ishak, Z. Kornain, and M. Abdul Jamil, "The development of air quality monitoring system," *J. Eng. Technol.*, vol. 1, pp. 69–73, 2011.

[2] A. M. Leman, A. R. Omar, W. Jung, and M. Z. M. Yusof, "The development of an industrial air pollution monitoring system for safety and health enhancement and a sustainable work environment using QFD approach," *Asian J. Qual.*, vol. 11, no. 2, pp. 165–182, Aug. 2010, doi: 10.1108/15982681011075970.

[3] L. Chia Woon, "Obstacle Avoidance Robot Applying Fuzzy Control System," *Univ. Tun Hussein Onn Malaysia*, vol. 7, pp. 219–232, 2014.

[4] M. F. M. Jamatolail *et al.*, "Development of a Mobile Robot with Camera-based Target Tracking and Obstacle Avoidance Systems," *Int. J. Integr. Eng.*, vol. 12, no. 7, pp. 236–245, 2020, doi: 10.30880/ijie.2020.12.07.026.

[5] M. T. Ibrahim, D. Hanafi, and R. Ghoni, "Autonomous navigation for a dynamical hexapod robot using fuzzy logic controller," in *Procedia Engineering*, 2012, vol. 38, pp. 330–341, doi: 10.1016/j.proeng.2012.06.042.

[6] N. Adzhar, Y. Yusof, and M. A. Ahmad, "A review on autonomous mobile robot path planning algorithms," *Adv. Sci. Technol. Eng. Syst.*, vol. 5, no. 3, pp. 236–240, 2020, doi: 10.25046/aj050330.

[7] S. D. Pandure and P. L. Yannawar, "Design of Low Cost Self-Navigation Rover Based on IOT," *Adv. Robot. Autom.*, vol. 07, no. 02, 2018, doi: 10.4172/2168-9695.1000187.

[8] W. Rahiman and Z. Zainal, "An overview of development GPS navigation for autonomous car," *Proc. 2013 IEEE 8th Conf. Ind. Electron. Appl. ICIEA 2013*, pp. 1112–1118, 2013, doi: 10.1109/ICIEA.2013.6566533.

[9] S. Vigneshwaran, B. Nithya, K. Raghul, B. Nivas, and V. M. Kishore, "Design of Bus Tracking and Fuel Monitoring System," in

2020 6th International Conference on Advanced Computing and Communication Systems, ICACCS 2020, Mar. 2020, pp. 348–351, doi: 10.1109/ICACCS48705.2020.9074177.

[10] T. Agrawal and M. A. Qadeer, "Tracing Path with Arduino Uno using GPS and GPRS/GSM," *2018 Int. Conf. Comput. Power Commun. Technol. GUCON 2018*, pp. 1203–1208, Mar. 2019, doi: 10.1109/GUCON.2018.8674953.

[11] N. S. Sehwani, S. R. Sangle, and Y. N. Vadhavkar, ""Real time automobile tracking system with an automated security algorithm," *Proc. 2017 IEEE Int. Conf. Commun. Signal Process. ICCSP 2017*, vol. 2018-Janua, pp. 2125–2129, Feb. 2018, doi: 10.1109/ICCSP.2017.8286781.

[12] A. Rahman, A. Rahman, M. F. Aslam, and H. Ejaz, "GPS based Navigation and Collision Avoidance System using Ultrasonic Sensors and Image Processing for Autonomous Vehicle," *IJCER*, vol. 3, no. 4, pp. 195–202, 2014, Accessed: Feb. 16, 2017. [Online]. Available: http://ww.ijcer.org/index.php/ojs/article/view/596.

[13] R. C. Jisha, A. Jyothindranath, and L. Sajitha Kumary, ""Iot based school bus tracking and arrival time prediction," *2017 Int. Conf. Adv. Comput. Commun. Informatics, ICACCI 2017*, vol. 2017-Janua, pp. 509–514, Nov. 2017, doi: 10.1109/ICACCI.2017.8125890.