Graphical User Interface (GUI) Controlled Mobile Robot

M. H. Zulkefli, K. A. Mohd Annuar[*,a]*, S. H. Johari*[b]*, M. R. Mohamad Sapiee*[c]* and S. Ahmad*[d]

Department of Electrical Engineering Technology, Faculty of Engineering Technology,
Universiti Teknikal Malaysia Melaka, Malaysia
[a,*]*khalilazha@utem.edu.my,* [b]*siti.halma@utem.edu.my,* [c]*mohd.razali@utem.edu.my,*
[d]*suziana@utem.edu.my*

Abstract – *The advanced design and development of robotic technology in producing multi task are increasingly. In this paper presents about designing and developing mobile robot model that can be controlled using Graphical User Interface (GUI) via wireless protocol. This paper focuses on the control mobile robot by using the GUI as navigation control and the user can get a view an image and real time video on visual basic software. To address the problem of sired based control, XBee wireless communication circuit was used in mobile robot through a computer command. The development of this mobile robot consists of a chassis, a graphical user interface (GUI), XBee module, DC gear motor, camera, track wheels and microcontroller type PIC18F4550. Differential driving method using L298 circuit was used to control movement of the robot. In mechanical design, the wheel track has been used instead of conventional wheels to enable the robot to travel through different types of surfaces or rough terrain. In addition, wireless cameras was attached to the robot as a system of monitoring function. Finally, the robot will be designed to control wireless remote control that can control robots. Wireless remote control allows the user of an environment that is unsafe or dangerous device and evades wires or cables interfere with the movement of the robot.* **Copyright © 2015 Penerbit Akademia Baru - All rights reserved.**

Keywords: GUI, Monitoring system, Wireless, Image feedback, Mobile robot

1.0 INTRODUCTION

Nowadays, robotics is not a new field. It has been all over the place for a decade. For example the car maker uses automated machine to position a car frame, joint a part with spot-weld robot, bolt piece together, painting and priming. This project is to develop a mobile robot which is remotely controlled by mean of wireless application. The control is to be done through a graphical user interface (GUI). The robot must also be capable providing feedback through the use of electronic device. This project involves hardware and software part. This project has several applications in surveillance.

Mobile robot design is about art and skill development to create the useful robot for human application. Each part of mechanical, electrical and software should be studies to make sure that all mobile robot application can run smoothly and can complete the task given. In mechanical part, each measurement of the mobile robot design must be details and fixed which it is important factor to stability and functionality of robot. In electrical and software part also need research in order to develop a mobile robot that low price, robust and good performance.

Abdellatif [1] introduce a mobile service robot with a class of robot and the tools to understand in order to allow its motion or object conduct in such spaces like the environment at home as well as office. The development of autonomous mobile robots is give the effect of the decreasing prices of sensors and computer. Other while to autonomous mobile robots is in advance much interest of it. Also, to increase the quality of live with the ascending need for their application in human friendly surroundings.

Using the Fuzzy logic approach in robotics give many positive applications and considered as an intelligent computational method. Fuzzy Logic Control (FLC) allows the system to hedge the hesitation from disturbing the control actions. In other method, they propose a method by via potential field philosophy to integrate the behaviour decisions. It proved be very well-organized specifically for fast robots. The prototypical of imaging and measurements of aim position from the colour image, it stated the Tone, Saturation and Intensity, HSI colour space is used from the time when it is found previously and perceptually constant. Other advantage is concerning the recognition of object from colour presence in the image is to get better results. They refer to the design of fuzzy logic controller in authority and the goal is allow the mobile robot to fulfil two objectives specifically; aim tracking behaviour, obstacle evading behaviour and else merging both behaviours.

The testing of robot control are use the system structures. In safe and sound controlling the robot to perceive the object by its colour, it was lead to discover the success of the control system. Moreover, were lead for separate self-determining behaviours and then for joined behaviours. A vision-based control system was applied and can enables a mobile robot to footpath and trail a moving object. Addition, using the potential field theory in the fusion of behaviour commands was successful in line for to the smooth resolutions from the specific behaviours.

Li et al., [2] use Wireless Sensor Networks (WSNs) to sense alterations in the surroundings. Low cost can be expend to large area can be monitored by this network. They have investigated by "unknown environment" that are intruder detection in a previously, it mean that the previously unknown to the WSN are the device signatures as well as forms of anomalies. To confirm if there is an invader in the zone the robot use the camera as an extra sensors. The important things they try to determine a systematic procedure on this network, so that it can sensitive only to real anomalies. They must have integrated a machine knowledge system into the WSN, so the network study to identify usual and unusual approaches of action automatically. Furthermore, the network can keeps learn from the past and the future of events without forgetting anything.

They have objectives to achieve in this network as to plan an accessible, well-organized and tough abnormality recognition system via WSN and other movable robots that will be positioned in an unidentified surroundings. The features to culture algorithm are first; capable to notice abnormalities in an unidentified surroundings with least human supervision, second; capable to straightforwardly scale to enormous numbers of motes, third; capable to care a hierarchical construction, fourth; computationally inexpensive, fifth; memory efficient, sixth; capable to identify time-related abnormalities online, seventh; modular, eighth; capable to endlessly monitor the surroundings, ninth; robust and tenth; able to adopt feedback. Nevertheless, several clustering systems more appropriate for some precise categories of data or applications.

In this network, they used architecture for the sensor networks, the fuzzy ART link, and Markov prototypical extension. On the hardware stages, wireless sensor network contains of two that

are fixed sensors (Crossbow motes) and movable robots (Pioneer 3 robots). The results are from many experiment such as intruder detection system, performance metrics, temporal change detection experiment and intruder detection experiment. This is the new approach system from that an invader recognition system by via a wireless sensor network and movable robots it able in the direction of detect time-related abnormalities.

In the wireless control, they have been achieve of three type wireless control. The first type of wireless control is the Artemia gesture control by light, second wireless control via magnetic field for underwater mechanical robot in addition the last is wireless sensor (ZigBee standard). The mainly targeted requirement of ZigBee are battery-powered applications everywhere small data rate, small cost and extended battery life. In command to control the gesture of Artemia populace to arrange three types of gesture patterns that are lining, round as well as zigzag that used in the wireless underwater robot system. That are proved Artemia group centred on identifying to transportable light spot and Artemia group be able to be controlled to change in any direction.

The wireless robot control system is easy to create, small cost and be able to control minor organism in minor area with execute some patterns like a group of Artemia and which is used as an instrument to execute a wireless control to citation behaviour of these organisms.

Sahbudin et al., [3] state security is the main issue similar to doors are the central entrance to our house, company or else whichever sort of building, it suggested a dependable door safety system be specifically designed. They want to achieve the improvement of a safety system with linkage capability via microcontroller MOTOROLA MC68HC11A8. Also, to planned on a market reasonable with a least cost. Moreover, the software part is established segment by segment because it includes a lot of analysis and correcting. It involve of three part such as a gathering program, server sideways program and client on the side program. They used the Eyewatch is primarily to connect with the microcontroller and accomplish database log on purpose. Winsock programming with Eyewatch that the client side program would communicate to notify the user about the door situation whether the door is obstructed or not. The mainly is the analysis actions are concentrated on communication in the middle of computer as well as the microcontroller. Also, this system uses keypad as an input method.

The experimental design of management program crossing point with microcontroller MC68HC11A8 as well as extra peripherals such as LCD display, private card magnetic device, photo device as well as keypad. These peripherals are positioned close to the door. VB are the core management program contains the subroutines that crossing point with other important peripherals and the management program will as well act as a server.

Besides that, the management system is planned to observer persons go in or go out from whichever rooms in a building. In this project it is planned for 4 rooms and supposing consume only one door. Through GUI interface it also allow user to observer the status of the room door. The important features included in this security monitoring systems are logoff or logon program, set timer, door block, set welcome message, check staff login database, check authorized user database, check unauthorized user database, send email, LAN chat, simulation, help, about, exit, door database and show time control. There are two types of passwords that are the password for spending this program and the passwords to admission to the plug-in database.

VB communication control connects with microcontroller by sending ASCII character. However, microcontroller consist of send and receive program (assembly language) and

hardware. The client plug-in is to be in user's computer for the determination to notify the user about the door situation. Hence, a sample door has been created and the system has been experienced as well. It superbly accomplished the objectives. Also, it suggested the system can be improved by using wireless application as well as smart card.

In this way, human can tell the robot to change directions, take measurements and so on. For example, mobile robot can let security personal stay in a central office and still check out unsupervised areas in a warehouse or other site. This is a new venture that is focused on intelligent mobile robot that are used in flexible environment and not as automated tool set in fixed location.

2.0 METHODOLOGY

2.1 Design Concept

Mobile robot design is about art and skill development to create the useful robot for human application. Each part of mechanical, electrical and software should be studies to make sure that all mobile robot application can run smoothly and can complete the task given. In mechanical part, each measurement of the mobile robot design must be details and fixed which it is important factor to stability and functionality of robot. In electrical and software part also need research in order to develop a mobile robot that low price, robust and good performance.
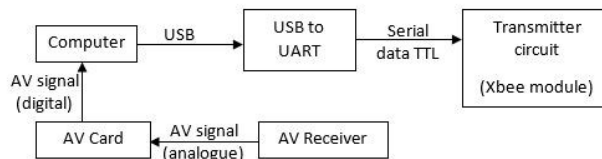
Figure 1: Navigation control centre block diagram
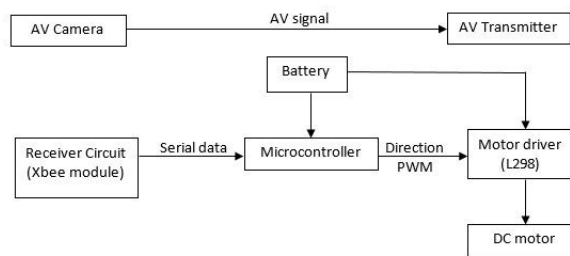
**Figure 2:** Mobile robot block diagram

2.2 Hardware

Mechanical hardware development consists of chassis robot (Perspex), dc gear motor and dc motor. All this parts perform the important role to the entire operation of mobile robot. Without good design, model of this mobile robot may not comply with the condition need and not suite in any robotic application.

Figure 3: Mechanical hardware

Electronic hardware development in this project, include circuit model developed in Proteus software through the training process and then simulation will be done. After simulation phase is done, PCB can be fabricated to assemble electronic component.
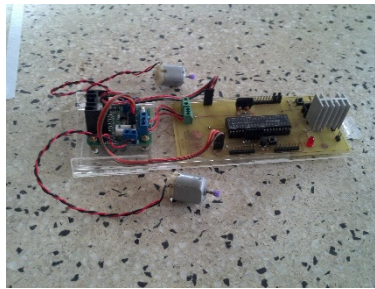

Figure 4: Electronic hardware

2.3 Software

The major software that is used to design this mobile robot is MPLAB compiler, Proteus and Visual Basic 2010 software. This software are related each other where are used to compile the coding and to run the simulation. Compile the coding and run the simulation are most important before applied in the real mobile robot because the error that been occurred in coding and design easier to trace.

A Graphical User Interface (GUI) is a human-computer interface or simply defined as a way for humans to interact with computer. There are many programming language that user can choose to develop a windows application. But through this project will focus on developing windows application using visual basic programming software.

Microsoft Visual Basic is a form of high level language that help user to create a windows application easier because it is an object orientated programming. What make Visual Basic famous around beginner it is drag and drop type of programming with simple coding required. As any windows application programming, Visual Basic is Event Base Programming. An event base programming only response when an event is triggered for example, when an event of clicking a button is occur, then the system will response.
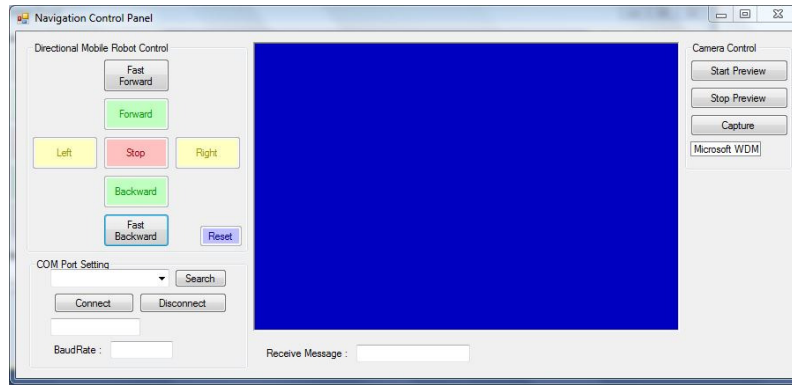
Figure 5: GUI design via Microsoft Visual Basic

The microcontroller's CPU reads program code from memory, one instruction at a time, decodes each instruction, and then executes it. All memory contents both program code and data is in binary form strings of 1s and 0s. Instructions are binary codes that tell the CPU what to do while the data values are the binary (numerical) values that the CPU adds, subtracts, handles as address values, or otherwise operate on or processes in accordance with the instructions.

Use of higher-level programming languages, such as C, resolves these problems. Programs written in C are very portable, since they can generally work on any CPU type without modification. They are also easier (for humans) to write and read, since they are more compact and use a much more descriptive set of English words and abbreviations.

```c
void forward (void) //Function to run forward
{
CCPR1L=CCPR2L=200; //assign speed to respective motor pwm pin

lm_run(0); //assign the direction to respective motor
rm_run(0);
//display the current situation
}
void backward (void) //Function to run backward
{
CCPR1L=CCPR2L=200;

lm_run(1);
rm_run(1);

}
```

**Figure 6:** Example of C language

3.0 RESULT AND DISCUSSION

The result once the mobile robot is complete, mobile robot able to move around which is remotely controlled by mean of wireless application. The control is done through a graphical user interface (GUI) by using Visual Basic. The robot can providing image feedback through the use of electronic device to the (GUI).

The mobile robot is used to monitoring the situation of the disaster area. The situation of the disaster area is unpredictable and unsafely. The mobile robot would have the ability to move in the several kind of surface. Figure 8 to Figure 11 show the robot move in the various surfaces.
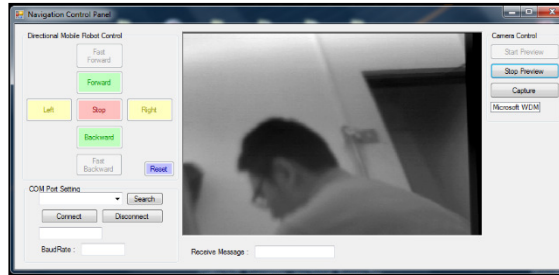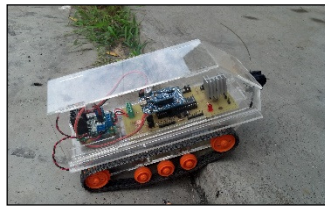
Figure 7: View of navigation control centre from user
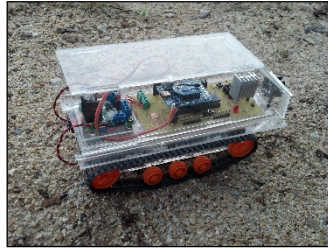
Figure 8: Mobile robot move on dirt

Figure 9: Mobile robot climb sentence high ground

Figure 10: Mobile robot move on grass

Figure 11: Mobile robot move on road

4.0 CONCLUSION

For conclusion, to develop the GUI controlled mobile robot that can perform well, the mechanical hardware development, electronic hardware development and software

development as navigation of robot play an important role. In addition, in realizing the objective of controlled mobile robot using GUI also give the impact to the making of the robot. In term of communication between robot and computer the Xbee is use to apply wireless application. Suggestion from this project is need to upgrading about communication range of GUI controlled mobile Robot. For this prototype version we use Xbee as a wireless device. The max range for Xbee wireless device is 100 m on outdoor and 30 m for indoor. But after we test on full scale application point to point on project the excellent range for experimental testing is bellow than 20 m. To solve this problem replacing the Xbee WIFI wirelles device. By using the Xbee WIFI as wireless device development cost will be save and the circuit base not need to change.

ACKNOWLEDGMENT

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