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Wireless Controlled Omnidirectional Monitoring Robot With Video Support

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ABSTRACT

This paper presents the function of Wireless controlled omnidirectional monitoring robot with video support. This project is an elementary that can be controlled with using RF mode and with camera on the robot surface. Generally, the RF has the advantage of adequate range up to 200 meters with proper antennas and the proposed monitoring robot is omnidirectional that it can move in forward and reverse directions, monitoring robot also is able to steer it towards left and right direction. It also have additional webcam/camera that can display on the monitor screen by using the wireless mode, beside that this project also using EPIC software and PIC Microcontroller for controlled the robot. To make sure that the objectives of this project achieved, a systematic method have been applied in order to obtain the future development of the robot especially for the robot motor control circuit and actuator mechanical system.

Keywords - PIC Microcontoller, Epic Software, RF transmitter and receiver.

I. INTRODUCTION

Technology is the making, usage, and knowledge of tools, machines, techniques, systems or methods of organization in order to solve a problem or perform a specific function. It can also refer to the collection of such tools, machinery, and procedures [1]. Technology has affected society and its surroundings in a number of ways. In many societies, technology has helped develop more advanced economies and has allowed the rise of a leisure class [2].

The implementation of this project is to resolve the problem of replacing a human work with wireless controlled omnidirectional monitoring robot with video support that completely controlled with wireless network. The recent developments in technology which permit the use technology such as wireless, using wireless it have capabilities of communicating with each other [3]. Wireless is a new technology, which has at its center the goal of eliminating wired connections between computers. Instead of connecting with wires, every appliance has small transmitters/receivers [4].

The project is to detect an object that is located at some distance within the range of RF transmitter with webcam. The webcam that have used is a camera which is feeds its images in real time to a computer or computer network, often via USB [5]. Other than that, with this webcam the project is more better because as a security surveillance and there are also uses on sites like video broadcasting services and for recording social videos.

This project also can move in forward and reverse directions. Beside that it also is able to steer it towards left and right directions where the controller circuit and webcam is put it on the surface of robot (like car controlled). Automation is today's fact, where things are being controlled automatically, usually the basic tasks of movement, either remotely or in close proximity [6]. The concept of wireless controlled omnidirectional monitoring robot devices is using the wireless that is more reliable nowadays; any time in the world today can be a reality. Assume a system where from the processing image (monitor), the user could view the image that appear in monitor screen and decides to take control the movement by using RF transmitter to view the dangerous area [7].

II. DESIGN PROJECT

There was a two way association between the model and the implementation. The basic features of the model were used to drive the implementation, while the lessons learned during the implementation were used to refine the model. It is therefore expected that there is a direct mapping between the model and the system.

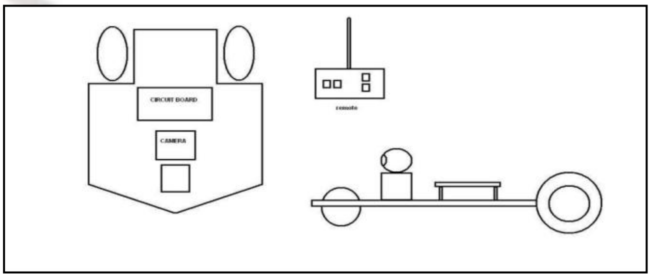

Figure 1. Basic model of project

Figure 2. Implementation of real model

Similar to the model the real system is using the body part of car control which is use to cover the circuit and put the battery 12V on the top of surface. From the figure, this project has using the part of body car control and for circuit and webcam is put on the surface of car controlled. The car has three tires with one on the front and another two big tires is on the back side of car. A laptop or computer can be used as monitor screen/image processing.

Besides that, the project begins by programming the microcontroller for serial communication with PIC 16F84A interface using EPIC software, the receiver PT 2272M decoder which is receives the data and decodes the information. While for PT 2262M is a part of transmitter which is a remote control encoder paired with PT 2272M utilizing CMOS technology. This project also used ULN2803 which is a pin chip of eight Darlington arrays which is used to drive the relays. To keep the design as simple as possible, the 4 relay SPDT and two motor have been used to move the car controlled which is can move without any problem.

The most important part is Wireless camera used for object detection is mounted on the surface of robot. It is a wireless video webcam RF communication range. Other than that, webcam connected to the monitor screen using RF Module receiver. Special module used to the video stream from a webcam to assist or enhance a user's control of applications.

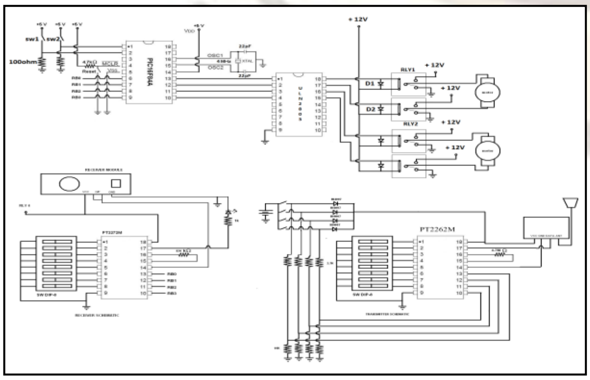

Figure 3. Circuit of project

Circuit Design

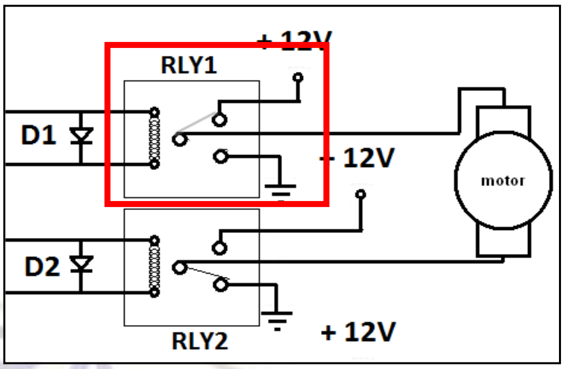

Figure 4. Circuit of Motor (Normally Open)

Normally Open:

When the electromagnet is energized, the voltage moves to the coil and produce an electromagnetic that will cause the armature (normally close to normally open).

When the DC 12V entering/ flowing to the circuit, it will rotate the motor and following the clockwise and then flowing to the second relay to the ground. So, car control can move forward.

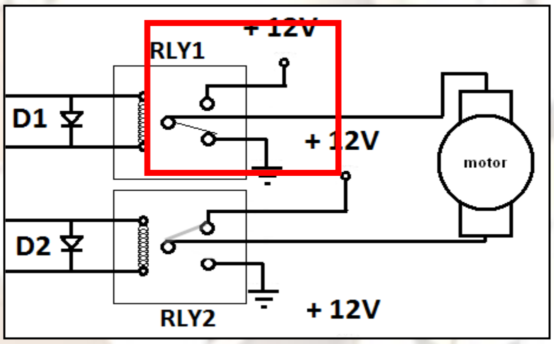

Figure 5. Circuit of Motor (Normally close)

Normally Close

When relay 2 is normally open, same as before, when the electromagnet is energized, the voltage moves to the coil and produce an electromagnetic that will cause the armature (normally close to normally open).

When the DC 12V entering/ flowing to the circuit, it will rotate the motor and following the anticlockwise and then flowing to the first relay to the ground. So, car control can move backward.

III. Results and Discussions

At the end of this project, the system is expected to provide the transmitter that is the control unit and a receiver that can connect to the robot. Besides that, this wireless controlled robot can move in forward and reverse directions and able to steer it towards left and right direction. The expected result for wireless controlled omnidirectional monitoring robot with video support as below:

- To fabricate microcontroller circuit

- To fabricate Transmitter circuit
- To design the prototype of project
- To fabricate receiver circuit
- To combined wireless webcam connection with PLC microcontroller

In terms of design, use of appropriate circuit components and can meet the expected features and specifications. For part programming and installation, using EPIC software can help move the robot and webcam can be function

Moreover, the management, organization, reliability and punctuality of the project are expected in well planned. A good report is a also expected which able to show the achievement related to the project, the procedures, the theoretical, and practical techniques and making suggestions for improvement or further work based on the experiences.

This project has demonstrated how to get a fully functional to developed and to detect the image and record the video. This included the 4 stage that have successfully done is PLC microcontroller stage, receiver stage, transmitter and wireless webcam. Besides that, the most important thing is the programming that has been function to give a movement for car controlled. The software that has been used is EPIC software. These programming that have used give more function to wireless controlled monitoring robot with video support which is successfully giving a good result**.**

This software was developed to work in programmed the PIC16F84A in order to provide useful functionality to get a movement. Besides, the body car controlled has been used to give the neat in design. In order to get a good achievement on this project, the testing on the wireless controlled omnidirectional monitoring robot has conducted.

SPEED TESTS

To characterize the speed of the robot fully loaded with battery and camera. First laptop computer, owned by the user was used to issue commands, using the Hardware Interface and Remote Control programs. The Remote Control program was operated in terminal mode, as it was not possible to steer the robot remotely and maintain consistent speed whilst measuring the speed. The robot was placed on the floor of the laboratory, and markers were placed at a 6 meter interval.

A stopwatch was used to time the robot's passage between the markers, running at various speeds. The information obtained was used to calculate the speed of the robot is meters per second (ms-1), with three runs at each speed setting being made, then averaged. The speed settings were incremented in steps of 3, from 6 to 18. The lower speeds were not tested, as it was expected that the speed would increase linearly, allowing the lower equivalent speeds to be extrapolated

TABLE 1. Average speeds for speed settings 6 to 18

Speed Setting	Lower Limit (ms^{-1})	Higher Limit (ms^{-1})	Average value (ms^{-1})
6	0.2324	0.2498	0.24106
9	0.3990	0.4314	0.41519
12	0.5576	0.6061	0.58186
16	0.7622	0.8342	0.79822
18	0.8432	0.9254	0.88430

It was observed that the robot did not travel in a straight line, even when the same speed levels were input to each pair of motors. The robot would always pull to the right, and so it was necessary to place the robot to the right side of the test course, angled to the left, so that it would not collide with furniture before reaching the end marker. This naturally made the distance travelled between the markers difficult to determine, and was a source of uncertainty.

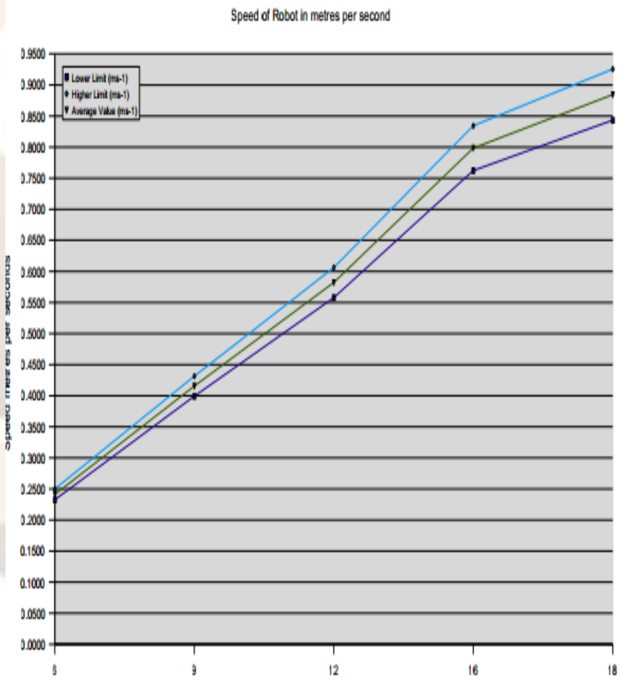

Figure 6. Graph showing approximate speed values (averaged over three readings)

OVERRIDE RELAY TESTS

The motors were observed to stop turning, accompanied by an audible click from the relay. This distance was observed to be just under 6 cm, which is the expected cut-off threshold (5.88 cm). It was observed that the motors did not stop immediately upon being the direction has given. Once the relay had switched, however, the motors stopped almost instantaneously. If a relay is occluded immediately after being triggered, the instruction to switch the relay will not be reached until the next time it is triggered, which, based upon simulations of the PIC code, could be up to 500.00 ms. A delay of half a second is clearly too great, as the robot can cover a 6cm distance within that time even on low speed settings.

FLOOR MOVEMENT TESTS WITH WEBCAM

To obtain on car controlled camera footage to aid development of the Vision System; specifically, footage from the robot moving forward at varying speeds, so that motion detecting video algorithms could be tested.

The laptop was developed to give the image on screen, and a webcam attached on the front of the car control, in roughly the position proposed for the final design. This, along with the RF receiver module, was connected via USB to the laptop, and the Serial Test Program was used to simple movement instructions (move forward at constant speed). The robot was tested moving forwards at 1/3, 2/3 and full forward speed. The video data from the web cam was recorded for each run. Tests were performed where furniture was placed in front of the robot, to examine the effect this had on the motion data obtained. One of the members also walked across the cameras field of vision to examine the effect of moving persons or object. The video feeds were obtained with no major incident. The movement of the robot was consistent and there were many visual references for use by the wireless controlled omnidirectional monitoring robot.. This test involved integrating the movement and Control System with the webcam Processing system, in terms of the speed setting applied to the motors, and the apparent velocity observed from the on car control camera.

The system produced as a result of this project provides of transmitter as controlling a robot, receiver and webcam which can be interfaced with using the RF module receiver. Since the Hardware is using PIC 16F84A as circuit orientated, the hardware can be modified into many movement that has been create in the programming system; this makes the software very flexible, allowing for future development of the robot.

The system could be improved by adding more function; these would be best to improve the quality of project and can give a picture or video in a quality of zooming. Since the PIC can be reprogrammed in circuit, the code can be updated easily. The unused PIC outputs are also brought out to connection points on the circuit board, meaning that the PCB will not require modifications. It would also be beneficial to incorporate a level of decision-making ability into the motor-override feature. More useful would be a system that could detect the direction that would potentially result in a collision, and override only movement commands that take the robot in that direction. This was considered beyond the ability of the author to implement in the available time; however a person with experience in machine intelligence should be able to come up with a workable solution.

The system meets the specifications. The webcam will detect objects up to 100 meters away, the speed and direction of the robot can be controlled very accurately, setting the speeds of the left and right motors independently. The hardware interface Class automatically moderates the acceleration of the robot, to prevent over-charging the motors. Another area with great potential for further work is the PIC microcontroller system. It would also be possible to rewrite the software associated with this project in a more organized fashion, packaging code into functions, and perhaps making the whole system (including the Remote Control Software) object orientated.

When undertaking any future projects of this nature, it will be necessary to prepare contingency plans in case of delays. Regular time-management sessions will also be a part of the project schedule, where Gantt charts will be updated and priorities re-assessed. This measure should help to highlight problems earlier. This project was successful in producing a system which meets the specifications given, there is much room for improvement of the System, however such modification should not be difficult to accomplish.

IV. CONCLUSION AND RECOMMENDATIONS

As a conclusion, the project was come out with the operations of Receiver and transmitter circuit. The functions and the operations of the circuits related are very important to be analyzed. With appropriate steps and methodology, any process of completing the project can be managed wisely and will be make a good result.

This final section of the report outlines some features that could potentially be implemented in future releases. The current set of features implement is a minimum to what a consumer would expect.

A feature that is seen in many vehicles today is the ability to see how economic user driving style and monitoring the image is in real time. In future, wireless controlled monitoring robot with video support can be upgrade with the omnidirectional 360 degrees and the functionality is having a movement at many sides.

Currently Wireless controlled omnidirectional monitoring robot with video support that can monitor using webcam. Having a limit of webcam with using the 9 volt battery may not be useful to some users of the system. An improved version of the rule system would be the inclusion of longer battery in order to improve the flexibility of the quality image. Implementing this extra functionality would require a complete image with video support.

Fully extend the antenna before operating the radio controlled vehicle. Not fully extending the antenna on the controller can affect user range and ability to control the wireless controlled omnidirectional monitoring with video support. If user car controlled is behaving erratically or isn't responding to the controls, it might simply be because user antenna is not fully extended. So, in future, the transmitter and receiver must be design to go further than 200 meter. At least can be 1 to 2KM depend on the environment, hard surface or other.

For future enhancement, this wireless controlled omnidirectional monitoring robot with video support can built the system with smart GPS that can inform the user about distance, direction and others. It should be possible to buy a module and connect it via the serial interface on car controlled. However implementing GPS functionality would require the development of a mapping system. The hardware side of GPS is relatively simple. All user do is request the current latitude and longitude co-ordinates.

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