MyRin: Control Motion of Robots through Spatial Difference of Power Supply from a Two Dimensional Communication Sheet

Natsuki Sakamoto*, Yuta Sugiura, Yasutoshi Makino, Masahiko Inami

Keio University Graduate School of Media Design

Abstract

We propose a method to transmit electric power wirelessly from a two dimensional communication sheet (2DC sheet) to a robot, to control the behavior of the robot. This robot consist of 2 antennas, a DC motor and 4 rectification circuits. The two antennas allow users to control the robot's movement by changing the amount of power supplied to the robot. We have also developed a card containing aluminum sheet, to control the amount of power received by the robot. When the robot stands on the aluminum sheet, the power received by the robot can be cut off. As our system does not require to mount any battery and sensor on the robot, the size and weight of the robot can be relatively small and light.

Keywords: Two Dimensional Communication, Tangible Programming for Robot Controlling, Wireless Power Transmission.

Index Terms: H.5.m [Information Interfaces and Presentation (e.g. HCI)]: Miscellaneous.

1 Introduction

A majority of the robots we are familiarize with, are such as toy robots or cleaning type house robots. There are numerous proposed methods to assist users to control these robots at free will, by inputting behavior tangibly, through other robots [1] or devices [2] such as touch display. These high performance robots are embedded with microcontrollers and sensors to understand its surroundings. For a simple functioned robot, there are methods to control the robot's movement by obtaining information from its surroundings [3].

Furthermore, in order to generate motion on the robot, the robot require either sensors to measure different interactions, or wireless communication to communicate with other devices. This may bulk up the size of the robot. For a high performance system, users have to bring in a new system into their surrounding environment with the anticipation that failures or errors may occur.

For our project, batteries are not required as energy will be supplied from a 2DC sheet. Users can easily build their own robot by just using an actuator. In addition, we propose a method to control the amount of energy supply by placing a card on the system.

Our proposal advantages in 3 main points; the size of the robot or system is small, the maintenance is simple and it can be used for a longer period of time. In addition, users can provide input intuitively and control the robot synchronously without the need of an external controller. Users can use their own creativity to manipulate the size and shape of the card to control the robot to their desired outcome. This gives users a new kind of experience to create and design their own robot and controller.

* natsuki210@kmd.keio.ac.jp

2 Principle

In this session, we will describe the principle of our system. We utilize a 2DC system [4] to transmit power wirelessly to the robot. Microwaves will propagate on the 2DC sheet, and will leak from the surface of the sheet. The 2DC coupler will then absorb this energy. When we place a metal plate on the 2DC sheet, the microwaves will be fully reflected back into the sheet, preventing power from reaching the antenna placed on top of the plate. We can repeat this phenomenon by substituting the metal plate with a thin film sheet such as an aluminum foil.

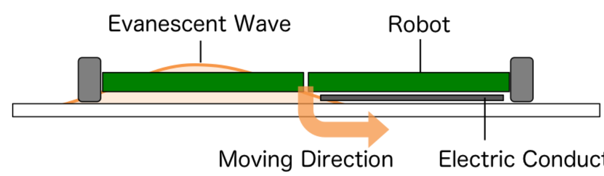

Figure 1: Robot.

3 Implementation

Our system is composed of two parts; the first part is the power transmission through a high-frequency oscillator and 2DC sheet, and the second part is the robot and the card (Figure 2). We used a 31cm × 60cm size 2DC sheet in this research.

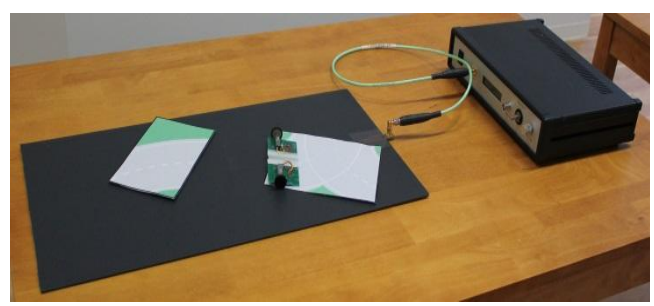

Figure 2: Overall System.

3.1 Robot

The robot of this system consists of a 5cm × 5cm coupler (Figure 3 left) equipped in each motor.

We connected two motors together and created a 5cm × 12cm car robot (Figure 3 right).

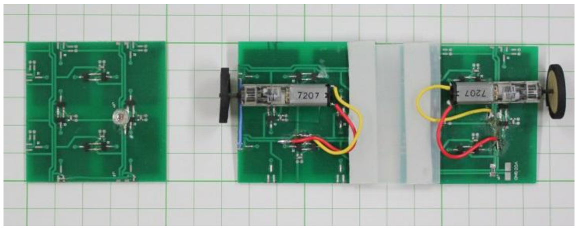

Figure 3: Coupler (Left) and Car robot (Right).

3.2 Card for Motion Control

The card will support the robot's movement. In order to reduce the thickness of the metallic plate on the card, we utilize aluminum foil. When a coupler is placed in the center of a 6cm square aluminum sheet, it is possible to completely cut off the energy supply. When we placed the cards in front of the car robot, we can control its movement. The basic motions that can be controlled are "Curve", "Slowdown" and "Stop". For "Curve", one coupler will cross on top of the aluminum foil while the other will not. Through this, one of the motor will stop and the other will operate, allowing the robot to curve. The angle of curvature can also be controlled by changing the size of the aluminum foil. For "Slowdown", a mesh type aluminum sheet will be placed under the card and this will reduce the speed of the robot passing over it. For "Stop", if both couplers crosses the aluminum sheet, the robot will stop. In this paper, Fig.4 to Fig.8 illustrates the robot movements using these cards.

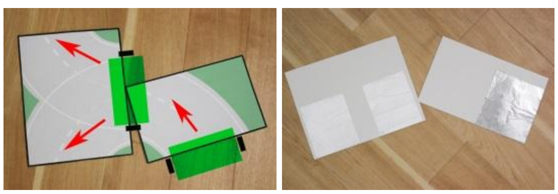

Figure 4: Card for curve motion.

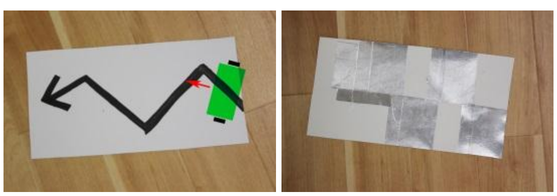

Figure 5: Card for Zigzag motion.

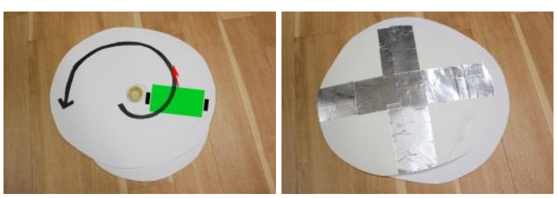

Figure 6: Card for rotation motion.

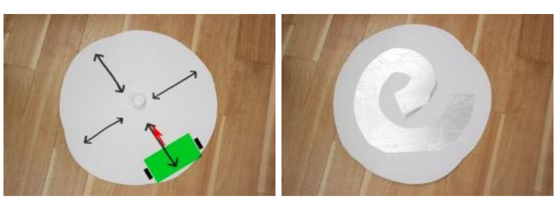

Figure 7: Concenter card.

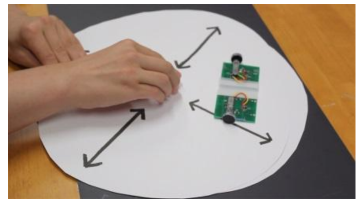

Figure 8: The card can control the speed to centralize.

4 Demonstration

By utilizing the phenomenon of a 2DC system, we tested the use of the cards by placing it in front of the robot, to control the direction of the robot. This robot control is performed by predicting the motion of the robot. There are situations where the robot might move to another direction as compare to what the card guides it to, or situations where it may be hard to control the robot.

However, this may be solved by improving the surface design of the card and the surrounding. For example, in order to control the 「Stop」 and 「Go」 of the door illustrated in Figure 9, the design is not just limited to the door, but also the design of the outer wall.

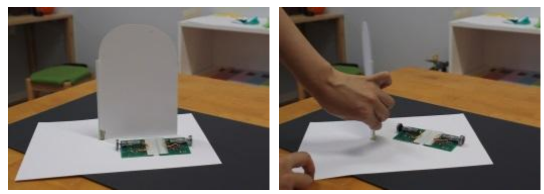

Figure 9: Robot move when user opens the door.

5 Conclusion

We propose a simple method to control the robots when it passes through a particular location. The implementation of this system does not require a high performance robot or to introduce any huge facilities into the environment.

The next step is to create complex sequence for the robot through different combination of cards. We will focus on the design method of the cards and the space surrounding the 2DC sheet. Therefore, we want to propose an ideal environment to make the robot and control its movement with better efficiency.

Acknowledgement

This work was supported by the Strategic Information and Communication R&D Promotion Programme (SCOPE) of the Ministry of Internal Affairs and Communications, Japan.

References

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