REMOTELY CONTROLLED SERCUR MAIN GATE SYSTEM

Shihab Sultan Salim Al-Kalbani
shihabsultan210@gmail.com
KDU University College
JalanSS22/41, Damansara Jaya Petaling, Selangor 47400 Malaysia

Abstract- Gate control system is very common nowadays. However, the gate control system using smart phone has not been seen in the market yet. This project presents a gate remote control system using android software in the smart phone. The project will develop a remote control platform in the smart phone so that it can incorporate with Bluetooth. When the Bluetooth is turned ON, the remote control platform can control the gate ON and OFF. To be able receive the Bluetooth signal, the gate has use a Bluetooth chip. Once the Bluetooth chip receives the incoming signal, the microcontroller will read the signal and trigger the relay to turn ON and OFF the gate. At the end of the project, a working prototype should be able demonstrate a basic gate control using smart phone. Typical smart phone used in the project is Samsung Note2. Two buttons will be developed in the Android software. One is for turn ON the gate and the other is for turn OFF the gate.

Keywords: Android remote control, Gate, ON/OFF, Bluetooth

I. INTRODUCTION

Main gate security system has a very wide market since everybody is looking for secure life, there is the remote control with two buttons open, those devices are exists in standalone unit which makes the user tends to carry extra item in his key chain using the wireless technology, but without a password, in other hand the one stick to the house wall and can write the password and then you can access to the house. Remote control of house's gate system becomes convenient for many house owners who access and exit from the house daily. But still there are some technical problems, because it does not provide the full secure.

The current technology to remotely control the gate is using a RF transmitter device or remote control device. The operating frequency of the remote control is less than 100MHz and varies from device to device.

There are normally two basic buttons used in the gate remote control system. One is for the gate open and the second one is to close the gate. No doubt that the current gate control devices are small in size, light weight and easy to operate. However, my project can be one of the new ideas that have a special way of providing the smooth securing to the main gate, which take it feather step to the new technology, by control it using the main controller module in the phone. And that will make it easier and it will solve most of the problems.

This research is about to develop a gate remote control system using a cell phone. The presented project will show application software in the cell phone which can control the gate open and close. The control technique is using Bluetooth technology.

The special features developed in the software consist of two buttons and password access to the application. The two buttons are used by the user to quick control of the gate open and closed. The password is used to protect the application software from illegal users.

Apart from software developed in the cell phone, the project also involve the construction of gate model. For convenient of demonstration, a sliding gate door will be constructed. The sliding gate door has a DC motor attached either on top or at the bottom of the gate. The shaft of the DC motor is attached with bearing or roller. As the DC motor is activated, the roller roll along the track of the sliding door, thus this causes the gate door open or closed. The operation of DC motor is controlled by microcontroller.

Beside control the DC motor, the microcontroller also responsible detects the incoming signal from the Bluetooth and sensor. The sensor is an IR sensor where it is used to detect an object enters the house. When the object already in the house, the IR sensor gives signal to the microcontroller. The microcontroller then triggers the DC motor so that the gate is closed.

Another features add into the system is a backup power supply. The backup power supply is to prevent shut down of electricity which may affect the operation of the gate. This is one of the solutions that this project provides.

In summary, the project basically uses a cell phone remotely control the house gate open and closed. When an object enters the house, the gate will close automatically.

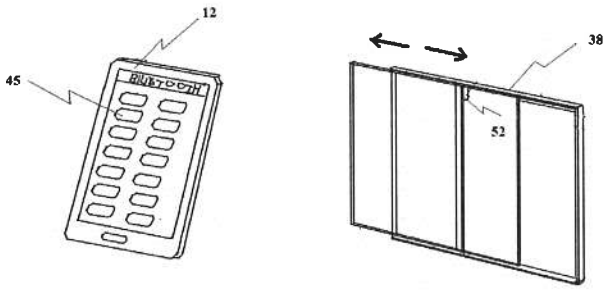


Figure 1: Expected outcome of the project.

Figure 1 shows the expected outcome of the prototype. The developed prototype comprising of Bluetooth communication device (12) where Android software is used and has a control button (45) and a gate prototype (38) with DC motor attached (52).

The material used construct the (38) is an iron material. The said (52) has shaft at which it attached to the sprocket and rest on the station chain. The number teeth used in the sprocket is 15. As the said (52) is activated by the control centre (not shown), the sprocket rotates along the chain which make the gate slide in and out.

In the said (12), only two buttons will be used. One is for open the gate and the other is for closed the gate.

II. TECHNICAL DESIGN

The overal technical implementation of the researh can be divided into two parts: hardware development and software development.

A. Hardware Development

Figure 2. Shows the proposed technical design for the hardware to control the gate open and close.

As seen in the diagram, the main component is the PIC16F877A microcontroller. This microcontroller is power up by 12V DC power supply. By use the LM7805, the 12V is then regulated down into 5V. Thus, the microcontroller requires 5V to operate.

Capacitor 100uF and 10uF are used to prevent transient voltage and holds a constant voltage of 5V across the output of the LM7805 voltage regulator. The 20MHz crystal oscillator connected to the microcontroller is to provide a clock timing for the microcontroller [2].

The LM1117 voltage regulator regulates the voltage from the output of the LM7805 down into 3.3V. This voltage is requires by the Bluetooth chip to operate. When the microcontroller receives the Bluetooth signal, it triggers the relay so that the DC motor can turn to the respective direction. Note that two relays used with one is for controlling clockwise turning and the other one is controlling anticlockwise turning [1].

The transistor 2N2222A is used to trigger the relay by enhancing its collector current from the base terminal. The LM7812 provide constant 12V supply to the relays and DC motor.

The entire circuit operation basically depends on the program design or the program embedded inside the microcontroller. The programming design will be shown in the next section.

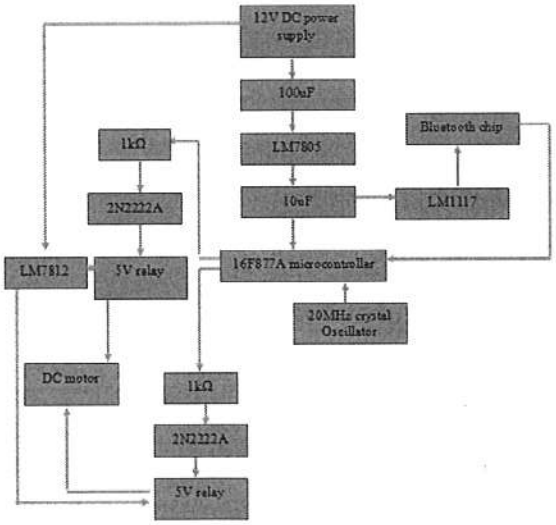


Figure 2: Technical design of the system.

The overall operation of the prototype mainly depends on the PIC16F877A microcontroller, especially the program design on it.

B. Programming Design for PIC16F877A Microcontroller

The program design for the microcontroller consists of infinite loop function, "if" function, "read" function and "trigger output high" function.

Figure 3 shows the design of the program to control the gate open and close. As seen in Figure 3, the program will constantly detect the input signal from the Bluetooth chip. If the Bluetooth chip receiver character "A" from

the smart phone, the microcontroller will trigger relay 1 otherwise the microcontroller will trigger relay 2 if character "a" is detected. The two characters "A" and "a" are used to identify the gate open and closed.

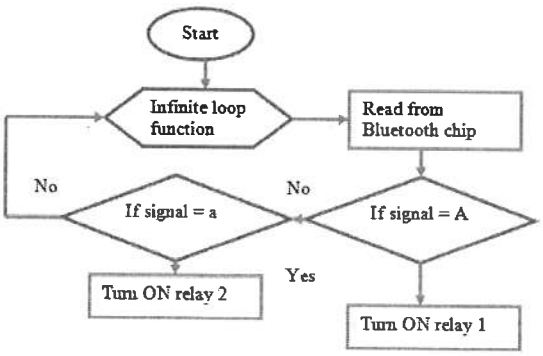


Figure 3: Programming design for PIC16F877A microcontroller to read and trigger the gate.

C. Android Program SAMSUNG Note 2 Cell Phone to Control the Gate

The Android remote control platform is a simple platform. It has a programming function using "if" command. The "if" command is used to check the condition of the two buttons pressed. When the button 1 is pressed, then a character "A" will be sent out. When button 2 is pressed, character "a" will be sent out. Other forms of characters will be considered invalid and the program will not work or response from them. Figure 4 shows the programming design for the Android remote control platform.

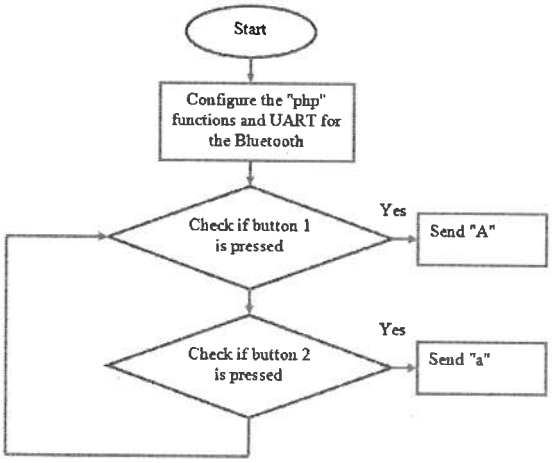
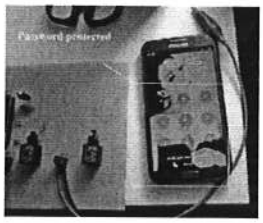


Figure 4: Android programming design for the remote control platform.

III. RESULTS

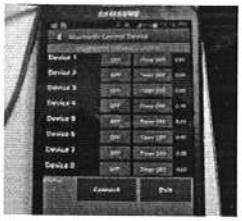
This section presents the complete prototype and experimental test carried out to collect the data. The gate is made from iron material and it is powered up by 12V DC energy. The diagram below shows the testing.



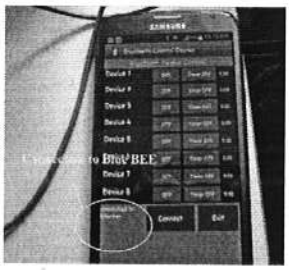
(a) Enter password for the phone

(b) System ready

(c) Connect the control board to power supply

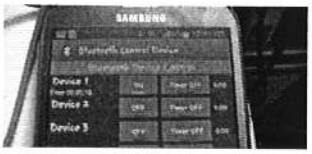


(d) Turn on Bluetooth

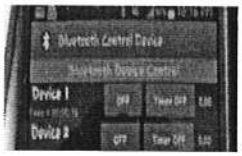


(e) Bluetooth connected.

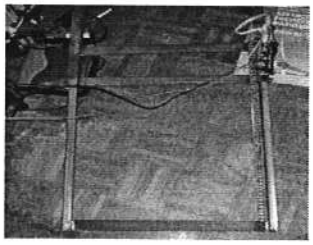
(f) Connect battery for the gate.



(g) Turn ON gate.



(h) Turn off gate.



(i) Gate open.

(j) Gate closed.

Figure 5: Gate control using Android.

Figure 5 shows the operation of the project and the gate is controlled by cell phone via Bluetooth technology.

The control system is simple in such a way that when the button of "ON" is pressed in the software, the gate open. When the button of "OFF" is pressed, the gate closed.

The overall operation can be summarized as shown below:

1. Turn ON the smart phone.
2. Access into Bluetooth GUI Apps.
3. Turn ON the Bluetooth by click on "Connect".
4. Switch ON the control board by connects it to 12V power supply.
5. Connect the motor and batter to the control board.
6. Now press the button at "Device 1" ON and OFF.
7. The gate should response accordingly.

The below shows the possibility of errors which might happen to the prototype when it is connected to 12V power supply:

1. The Bluetooth chip does not show the blinking LED light - Try to restart the whole control board. This happen because the microcontroller cannot catch the transient voltage.

2. The Bluetooth in the phone not pairing - Try turn OFF the timer of the Device 1.

3. The Bluetooth at the phone does not show Blue BEE - Try to restart the control board.

4. The gate DC motor not working - May be loose connection or the battery is weak.

It is observed that the performance of Bluetooth controller build on the PCB is much more stable compared to the one build on the breadboard. Table 1 shows the comparison performance between the breadboard and the final prototype build on the PCB.

TABLE 1: Performance of project on breadboard and PCB

No. of experiment	Output voltage (mV_{pp}) for breadboard	Output voltage (mV_{pp}) for PCB
1	960	960
2	730	955
3	850	961
4	770	958
5	830	960
6	650	961
7	720	957
8	880	959
9	945	960
10	721	960

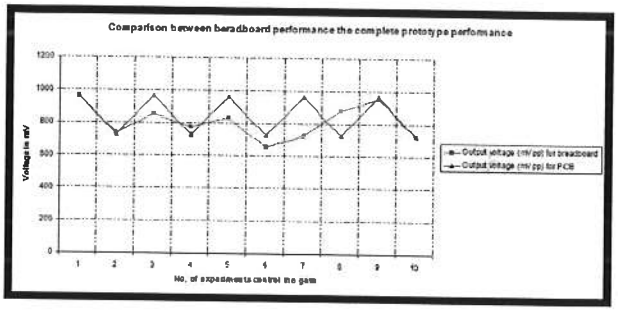


Figure 6: The plot for table 1.

TABLE 2: Signal strength measurement for the Bluetooth.

No. of experiment	Output voltage (mV_{pp})
1	960
2	845
3	730
4	660
5	543
6	489
7	330
8	300
9	202
10	150
11	88
12	73
13	43
14	31
15	20
16	13
17	6
18	0
19	0
20	0

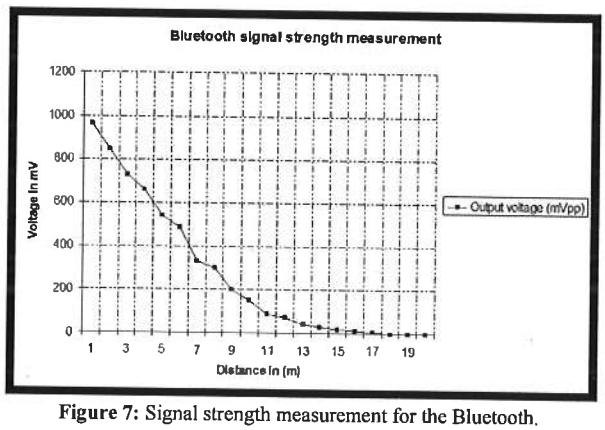


Figure 7: Signal strength measurement for the Bluetooth.

As seen in Figure 7, the longer the distance traveled, the lower the signal it is. The Bluetooth signal varnish after 20m from the receiver. Under that distance, the signals drop badly and almost to zero.

By looking into the exponential decay graph shown in Figure 7 the solution to describe such graph is [3]:

$$v(x) = ce^{-kx}$$

When substitute x = 1 or v(1), the expression become:

$$v(1) = 960mV\ e^{-k}$$

Thus, the general expression for the graph shown in Figure 7 is [4]:

$$v(x) = 960\ e^{-kx}\ mV$$

where k is a constant, x is a distance. By differentiate the v(x) with respect to x, we have [5]:

$$\frac{dv(x)}{x} = -960ke^{-kx}\ mV$$

TABLE 3: Current measurement for the DC motor.

No. Experiment	Current (A)
1	1.23
2	1.14
3	1.22
4	1.05
5	1.33
6	1.22
7	1.56
8	1.65
9	1.32
10	1.24

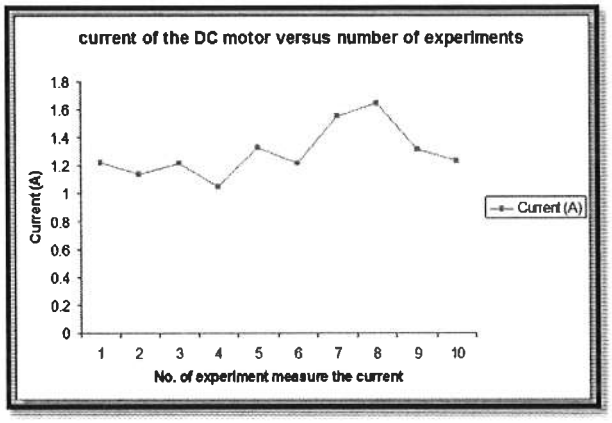


Figure 8: The current measurement for the DC motor.

Table 3 above shows the number of experimental test to measure the current on the DC motor. As seen in the graph, the current varies from one experiment to another experiment. This happens because the DC motor has no initial or reference time to turn on and the dynamic of the DC motor will affect the current flows.

Strength received will getting low and low. At far distance, the receiver will loss the reception of the transmit signal.

V. CONCLUSION

The idea of building a gate door control system using Android controller software is not just a circuit with a door and controlled by a cell phone. In fact the general idea is to provide the security, which is what people looking for to have the security to their house and the place they live in, rather they are inside or outside.

Secondly to provide the flexibility and the easy way of controlling things, the days of getting out of the car and open the door and drive the car inside the close the door, or when you can key chain that you carry it usually with you, what if accidently you lost it, or you forget to bring it with, that can gives a hard time and proofs it is indeed not that suitable enough yet

So, the idea of providing the security, the secure, and as well the flexible way is comes at once to this idea, and the experimental show how does the project work concentration on the challenging parts. However, it is found the Bluetooth control of gate depends on the pairing. The term pairing means both Bluetooth transceivers are seen in the network. The Bluetooth system at the smart phone transmit only "A" or "a" to identify the OPEN and CLOSE of the device.

The Android platform basically is a java script. However, to test run the project, one should have the java compiler and its apps so that the complete of desire GUI window can be designed to suit the application. In the experimental test, it is also found that as the transmitter is moves away from the receiver, the signal strength received will getting low and low. At far distance, the receiver will loss the reception of the transmit signal.

VI. REFERENCES

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