Portable Game Controller Using STM32

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Abstract— This paper aims at presenting an innovative way of converting a smart phone into a portable game controller using low cost ARM based STM32 microcontroller and arduino leonardo with a specific aim at improving the lag which occurs while using the traditional method by means of reducing the computational burden on hardware and using the algorithms in the smart phone itself making the device much more efficient and platform independent. The paper tackles the various issues involved in designing such kind of hardware and propose a foundation for developing the algorithms for smart phone based game controller.

Index Terms— Portable Game Controller,STM32 Microcontroller, Improving the lag, Reducing computational burden on hardware,

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1 INTRODUCTION

Games are one of the most widely used entertainment tool all over the world and there is a huge variety of games which are available in the market and to play with these games various different kinds of game controllers are required. But, it is hard to go for those expensive game controllers provided by big companies which are compatible with only the limited type of games.

This paper introduces the implementation of converting a bluetooth enabled smart-phone into a portable game controller by virtue of which any sort of game can be played by the user irrespective of type of the game . But while designing such a system , the biggest problem that occurs is the existence of lag while playing the game. This lag can be defined as the occurrence of delay between the time at which input is given from the smart phone and the response time at which the output is observed.

The problem statement concerned here is the development of general purpose portable game controller which will be compatible with any kind of game without any lag or delay whatsoever.

Traditional way of converting a smart phone into a game controller:

The concept of implementation of converting a smart phone into a game controller involves:

1.Reading the input signals from the smart phone from the user by which a user wants to play a game. Well these signals can vary from simple touch input in the form of buttons to the accelerometer or even voice input. In this accelerometer input and the touch inputs are being taken into the considerations.

2.Sending these signals from the phone to the device which will be plugged into the PC .Well for this purpose bluetooth is being used to transmit the data having the range of 10m and data rate

of 1Mbps which is suitable for this application as there is no point of having a range for 100m or so from where the game won't even be visible to the user. These signals are being received by the bluetooth module (HC05) and given to the arduino leonardo.

3. The arduino leonardo is used to read these signals from the bluetooth module and process these to serve as a keyboard to play that particular game.

The above procedure is the traditional way of developing such device which results in a lot of lag at the output which can make any user frustrated and thus making this approach highly inefficient .

Well this paper tackles this issue by making two crucial changes in this traditional approach:

1. Usually the analog floating inputs from the smart phone are given directly to the device without processing and the processing part is actually being done at the device side i.e. the hardware side which makes the entire process very slow and ineffective. Hence in this new approach the algorithms to deal with the user input are actually in the smartphone itself which is being done using the android application using eclipse IDE .Since the smart phone usually works at much higher clock frequency as compared to embedded microcontrollers, these algorithms can be processed with a much more higher rate as was earlier done in the hardware.

This approach will not only decrease the computational burden on the hardware i,e the device but also make the entire system much faster which will in turn significantly decrease the lag which is being observed in the earlier traditional approach.

2. The controller used was arduino leonardo which runs on at max 16Mhz clock frequency and hence it is a relatively slow processor for this kind of application. Hence rather than signals

which are processed by the arduino leonardo, are now being processed by the STM32F051R8 microcontroller which can run at 48 Mhz and toggles its GPIO pins at 60Mhz and at the same time one of the cheapest arm based microcontrollers provided by the STM for these commercial applications.

These GPIO pins of STM32 will be given as the input to the arduino leonardo which will serve as a keyboard. Hence most of large algorithms are being performed by the STM32 at much more faster rate as compared to arduino leonardo.

The question still exists what is the use of arduino leonardo now as STM32 is already being used so there may be no point in using the two controllers. Well arduino leonardo is being used because of its ability to seve as a keyboard and bypassing the other

USB ports connected with the PC and hence providing the entire control to the user at real time game interfacing.

IMPLEMENTATION:

The whole process can be summarised in a block diagram format which consist of a smart phone (i.e Samsung Galaxy S5830i) ,a bluetooth module(i.e HC05),ARM cortex M0 STM32 microcontroller(i.e STM32F051R8) and an AVR based Arduino Leonardo(working as a keyboard)in which smart phone is connected to the designed device consisting of STM32 ,Leonardo and bluetooth module via bluetooth network over a range of 10m and it is the device which is being plugged in to the PC via USB port and thus this device is basically a plug and play device which makes the user smart phone into a portable game controller.

Working:

The basic working of this device starts with connecting the smart phone to the bluetooth module HC05 as shown.
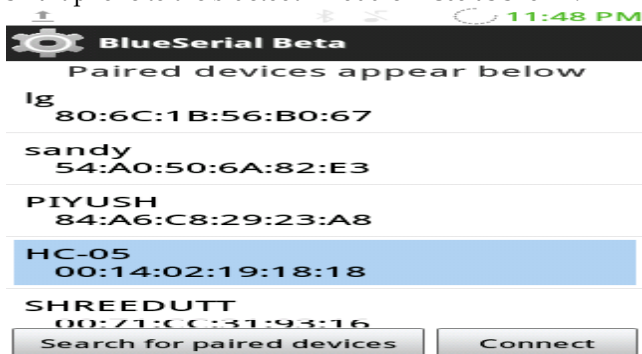
Then taking input from the user in the form of motion or tilt of the smart phone sensed by the accelerometer sensor and the beauty is that the phone iteself i,e inside the application itself contains the algorithm to handle these analog values which are shown in the figure.
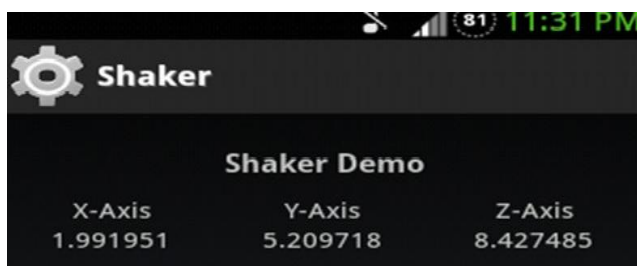
In this project a threshold value of 2 and -2 are being chosen but it can be generalised as per the needs of the user by virtue of which a user has to tilt his smart phone to certain desired angle and then press submit. In this way a user can set the various inputs as the various angles over which he wants to press a particular key from the keyboard.

one of the most popular games Subway surfer in which the following keys are being assigned:

Left Arrow key ---- Left tilt
Right Arrow key-----Right tilt
Top Arrow key------Front tilt
Bottom Arrow key ------ Back tilt

and is being successfully being played with the minimum lag of 10ms and the maximum lag of 40 ms which are suitable for playing any kind of game as compared to the traditional approach in which a delay lasts for more than 400ms .

Conclusion:

This paper hence presents the innovative approach towards playing the PC games and extending the use of smart phone to the next level by virtue of which making a smart phone more smarter and converting it into a portable and general purpose game controller which is independent of the type of the game as well as the platform over which the PC runs with the help of this plug and play device with the reduced delay and lag .

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