Developing an Algorithm for Learning IR Codes from IR Remote Controller

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Abstract- This paper presents a new algorithm based on MapReduce Design pattern. Idea to generate the algorithm is for automating learning process of IR remote control. This will be useful when communicating with the devices using IR and to create intelligent solutions. The manual process of learning IR code is tedious and cumbersome, because the structure of the protocol is unknown. This paper tries to provide a method how the manual process of learning IR code can be automated. Learning IR code is part of machine learning where the algorithm developed shall be able to learn different IR codes and help in repeating the same. This algorithm aims at grouping of data based on changing and non-changing bits of protocol according to bit position. Consolidate the results by reducing the repeated data and summarizing the changing bits.

Keywords – IR remote, MapReduce Design Pattern, IR Remote Code Frame Format

I. INTRODUCTION

Analysis of IR remote control codes is fundamental problem for the learner. In this era of information explosion today, complete and correct data is difficult to obtain manually. The Theme of my project is to developing an algorithm for learning IR remote codes. This will provide a method how the manual process of learning IR code can be automated. To enable the code format of IR remote, we consider the application of MapReduce design patterns [1-3]. The prevailing concept is analysis of code format from the actual IR remote control. The proposed method is based on principles of machine learning where the various aspects are evaluated before zeroing on the current approach for solving the problem.

The rest of the paper is organized as follows. Proposed Mapreduce based algorithm is explained in section II. The basic programming model is described in Section III. An implementation of the Map Reduce new algorithm towards our cluster-based code analysis is explained in Section IV and Section V. Implementation Result with example in sectionVI. Conclusion in section VII.

II. MAPREDUCE BASED ALGORITHM

A New MapReduce algorithm is the programming model. Mapreduce is implemented for large data set to reduce the data in the cluster [10]. MapReduce design pattern is an extension of unsupervised learning/clustering. Here new Mapreduce algorithm is implemented for analyzing the IR remote control codes from IR remote control in form of the frame format.

MapReduce is a programming model and an associated implementation for processing and generating large data sets with a parallel, distributed algorithm on a cluster.

The clustering method to solve the problem where data was grouped but not consistent with expected result always, because where we have to know the mean for grouping. Map-reduce is extension of k-mean (key/value pair) way of solving the problem where it provides a frame for achieving the results. In mapreduce here we are using the design pattern. A design pattern is a general repeatable solution to a commonly occurring problem in software design. A design pattern isn't a finished design that can be transformed directly into code. It is a description or

template for how to solve a problem that can be used in many different situations. This design pattern [5] is used for the problem that are occurred in the pattern of our frame format. A New mapreduce algorithm followed the dataflow steps that is mapping, partitioning, comparing and reducing [4]. A Mapreduce is composed of a map method that perform the filtering and sorting (partition) the data when the start value is repeated before that it comes under the one IR frame unit, that data is collected from the IR remote control by using the IR receiver and arm processor [10]. And a reduce method that perform the operation, it will reduce the data while doing the row comparison and column comparison that is within the byte. In row comparison the data in the two IR frame units are compared row wise, comparison the data in the IR frame units are compared column wise, the column comparison is within the byte and its limitation is up to 8 bits (1byte) and finally output that gives the IR remote control code analysis frame format. For getting the supervised data of any IR remote control this new algorithm based on mapreduce is applied. By applying this new algorithm we can learn the IR remote codes.

III. PROGRAMMING MODEL

The computation takes a set of input key/value (IR frame unit), and produces a set of output key/value IR frame unit. The user of the MapReduce library expresses as two functions: map and reduce.

Map, takes an inputs and produces a set of key/value (IR frame unit). The Mapreduce library groups together all values associated with the same key (IR frame unit) and passes them to reduce function. The reduce function, accepts a key (IR frame unit) and a set of values for that key (IR frame unit). It merges these values together to form possibly smaller set of values [14]. This allows us to construct IR remote code frame

IV. NATURE OF DATA

When a remote sequence is read it is a sequence of 0s and 1s (digital form). To understand the changing bit pattern multiple samples of key press is required. Input data is collected based on different combinational key press of remote control. The bit positions are not identified hence data cannot be associated with any key press. This becomes a problem of unsupervised learning where data has to be derived from the available data set.

All codes have address bits and data bits. Usually the data command is repeatedly sent as long as the key is being pressed. Some codes use a toggle bit, which changes its value at each key-press. Some codes send a pre- or post-burst at the beginning and/or at the end of each key press. And some codes send the data only once for each key-press. From NEC protocol and RC 5 we can collect the data but some proprietors doesn't expose their code.

EXAMPLE FOR COLLECTION OF DATA AND IMPLEMENTATION OF NEW ALGORITHM BASED ON MAPREDUCE WITH DESIGN PATTERN (COLLECTION OF DATA FOR NEC PROTOCOL):

A reliable and power saving transmission method in which bursts of the carrier frequency are transmitted is called "Pulse Code Modulation" (PCM). There are three commonly used representations of one bit in remote control systems which are described in the following diagrams. The "Bi Phase Coding" has one rising or falling edge in the Centre of each time slot (figure 1). In the "Pulse Distance Coding", all bursts have the same length but the time between the bursts is different depending on the value of the bit (figure 2). In the "Pulse Length Code", there are two kinds of burst lengths depending on the bit value (figure 3).

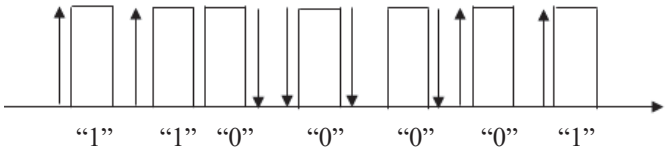


Figure. 1 - BI Phase Coding (a rising edge within a time window is equivalent to a "1", a falling edge represents a "0")

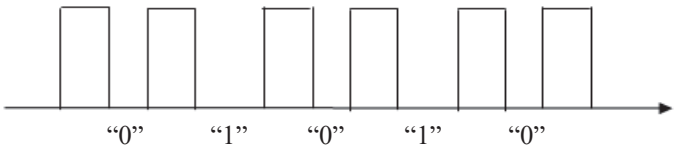


Figure. 2 - Pulse Distance Coding

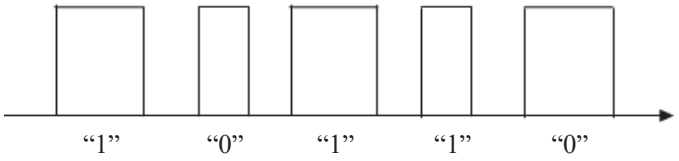


Figure. 3 - Pulse Length Coding

Some remote code uses bursts at a carrier frequency of 38 kHz. The remote code starts the transmission using a so called leader code, a burst with a length of 9 ms, followed by a pause of 4.5 ms and then the data. The original purpose of this leader code was to let the internal control loops in the receiver modules settle. After transmitting the data, only the leader code and a single bit are transmitted repeatedly for as long as a key is pressed. A special property of this code is a constant data length in combination with pulse distance modulation. The half period burst portion of each bit contains 22 pulses, each with a width of 8.77 µs and a period of 26.3 µs. A “0” is represented by a pulse distance of 1.125 ms and a “1” by a pulse distance of 2.25 ms. 8 address bits are used to identify the device to be controlled. A further 8 bits are used for the transmission of the command data. As mentioned above, the words are always followed, without a pause, by the inverted words. E.g., the transmission of the address data “10000000” and the command data “00000000” is performed by sending the bits:

“10000000’00000000’00000001’00001011”

In a special version of the NEC code, the pre-burst, including all of the address and data bits, is repeated in each 108 ms time slot for as long as the key is pressed.

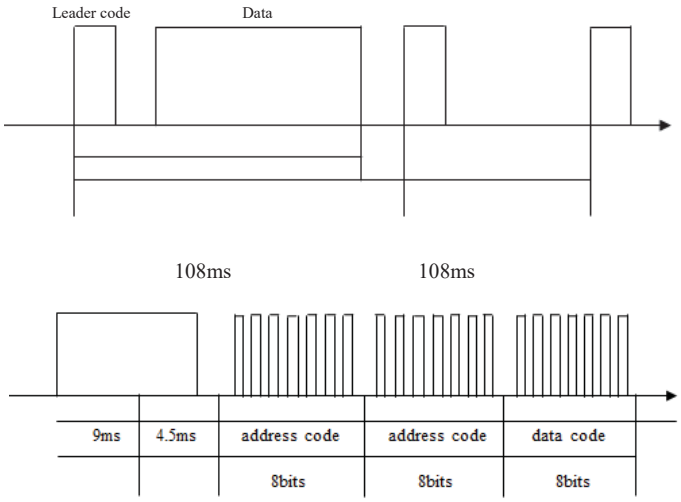


Figure. 5 –IR Remote Transmission Code

For some remotes didn’t get the data from proprietary at that time it is challenging to get the complete and correct data manually. To obtain the complete IR remote control data manually is by pressing the IR remote control key. The IR receiver capture the IR signal from a remote control and display the waveform on pc from that the operator can analyze binary pulse by a rising edge represents a “1” and a falling edge represents a “0” of pulse width modulation. After need to analyze that width of pulse, the length of code, Number of bits, key code, repeat code,

each frame unit has contain how many bits. Which bits are changing and which are constant in that frame unit, address bits, command bits etc. It is challenging for user to get the correct data and its take huge time for one remote. So, to improve the performance and to decrease the time here a new algorithm based on mapreduce design pattern is developed.

In this project IR receiver and arm processor are used to collect the data. Usually the data command is sent as long as the key is being pressed. The operator can directly observe the result of pressing a key by means of visual feedback.

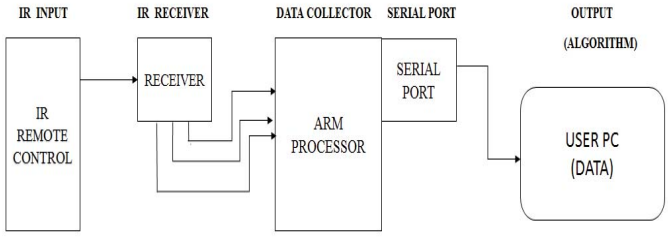
Now, the collected data is implemented to the new algorithm based on mapreduce with design pattern. By implementing this algorithm the intact frame format can be showed clearly and steadily on the computer, this is that most of the oscilloscope can't realize. From frame contains the width of pulse, the length of code, Number of bits, changing bits, constant bits, address bits, command bits, key code, repeat code, etc.

V. IMPLEMENTATION

The new algorithm is implemented for the analysis of IR remote code. With this mapreduce algorithm the IR remote codes can make a frame format.

Here to implement this new algorithm we need to have the remote control raw data. That raw data we are collected from the remote controller with the help of IR receiver and arm processor as shown in the section IV. In this new mapreduce algorithm the collected data is the input for mapping. Map function (method) that performs filtering and sorting for the collected data. Reduce task takes the output of Map function as its (key/value) input, with the IR frame units (key) do the row wise comparison and column wise comparison to reduce the data in the frame. While doing comparison the same values can be taken once. So, that the IR frame values are reduced by using this new mapreduce algorithm. Finally the IR frame format was constructed by using new developed algorithm. Open source implementations of MapReduce have been developed and the applicability of MapReduce to get an IR remote code frame format. The step by step process of our project is shown in the below block diagram.

BLOCK DIAGRAM:



VI. IMPLEMENTATION RESULT (EXAMPLE)

Mapreduce design pattern new clustering algorithm implementation. The bottleneck of the MapReduce-design pattern new clustering algorithm lies in four aspects:

1. Mapping the data
2. Comparison function
3. Reducing the data
4. The frame construction

Below we propose the solution, the implementation steps are as follows:

A. Step1: Mapping the Data:

In this paper, we use Map function [8,9] to map the raw data. The implementation process of the MapReduce-based new algorithm is as follows:

The map function takes a series of key/value array (IR frame unit), processes each, and generates zero or more output key/value arrays. The application is doing clusters, the map function would break the array into clusters when the starts value repeats and output a frame unit.

Partitioning the Data:

Each map function output is allocated to a particular reducer by the application's partition function for sharding purposes. The partition function is given the number of reducers and Returns the index of the desired reducer. Between the map and reduce stages, the data is shuffled in order to move the data from the map that produced it to the shard in which it will be reduce.

B. Step 2: Comparison Function:

Comparison function [10] is used to sort the final emitted outputs of reduce before returning the list of result values.

The frame construction which needs to do the row wise and column wise comparison for all the Key/value (IR frame unit) this brings with it a great complexity to reduce the code in the frame.

Comparison function is applied for the mapped data of first two rows of IR frame unit and next two rows of IR frame unit.

C. Step 3: Reducing the Data

The reduce function [11] once for each unique key in the sorted order. Reduce can iterate through the values that are associated with that and produce zero or more outputs. In the array example, the reduce function takes the input values, do the row and column comparison for each value in the array and if the values match while comparing then the matched value write only once.

Comparison [12] between the two rows of IR frame unit. The result of reduce function is redundancy of IR frame unit.

D. Step 4: Frame Construction

The final frame construction is done result by reducing the repeated data and summarizing the changing bits in IR remote codes.

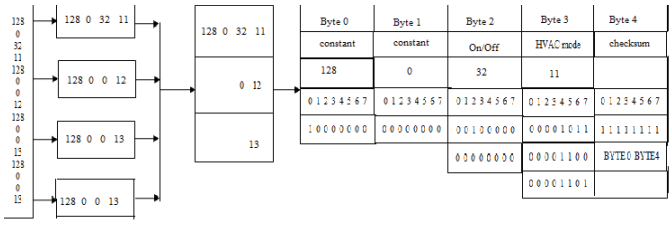


Figure.4. IR remote control code analysis frame format

VII. CONCLUSION

In this paper, we proposed a new algorithm called IR remote code analysis algorithm based on Mapreduce design pattern reduce the manual process of learning IR code can be automated. The proposed algorithm leverages the strength of the IR remote code algorithm and Mapreduce. The simulation results show that the IR remote code analysis algorithm can not only be used to construct an IR remote code frame format, but it also inherits the benefits of this algorithm; that is, it is parameter free and easy to implement. The simulation results show that the proposed algorithm performs very well on code analysis.

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