International Journal of Advance Research in Engineering, Science & Technology(IJAREST),
ISSN(O):2393-9877, ISSN(P): 2394-2444,
Volume 2,Issue 5, May- 2015, Impact Factor:2.125

DESIGN OF WIRELESS DATA ACQUISITION AND CONTROL SYSTEM USING LEGO TECHNIQUE

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Abstract
To have a rapid development in the field of science, control system & measurement, importance of wireless data acquisition system increases. This system is designed by the help of various high voltage based equipment's, electrical and electronic equipment's which are developed from LEGO technique. This is basically advanced system which contains inbuilt (DACS) which means Data Acquisition and Control system with wireless interaction. As this system contains special features which makes more reliable than any others system, besides this it is less complex than any other machine. WDAC system plays important role in consumer applications and industries prone areas. With the help of this wireless data acquisition system we can overcome the complex cables which are used for acquisition process. Today there are Different types of digital DAC systems present in the market which can be suitable for the substitution of multisite job operation. We can simply interact with the machine and interpretation of data can be easily done from single station, So data acquisition system is nothing but a process of taking input as a real world signal, for example a current or voltage input, into the personal computer for processing it and storage or analysis and also conditioning or various data manipulation.

Keywords *- Data Acquisition System (DACS), LEGO Technique, PIC microcontroller, Wireless, RF Identification*

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I. INTRODUCTION

The first concrete block was manufactured in 1868. Idea behind these modules was very simple, It was created in such a way that it can be easily fitted with each other and it can be removed as well as. These modules were made up of cement; once these were made the concrete block became suddenly the most usable construction units in the world.
Later on these modules were used for building the bridges, house etc. Around somewhat about 100 years later in 1947, Lego bricks were invented (automatic binding brick).In a few years Lego bricks were seen in every house hold. For these you don't have to be an engineer to make houses, bridges, buildings. Lego made it accessible. Lego made the concrete block (building block of the world) into a buildings block of our imagination.

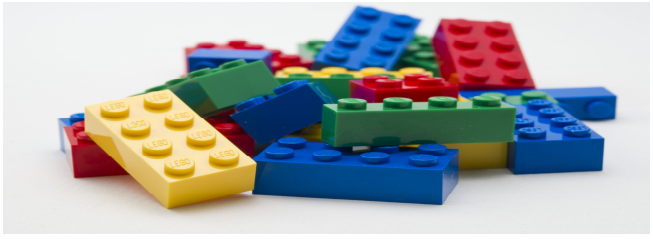

Fig.1 LEGO Bricks

The data acquisition system is a type of system which helps in acquiring the necessary information about a certain area of interest. Let us take an example of agriculture. In agriculture the farmers have to keep note of various factors of their fields like the moisture content in their field, the temperature and many other factors that are to be looked upon by the farmers. Traditionally the farmers will have to be physically present in their fields to keep a check on these factors and also they have to be present on their fields if they will have to control these parameters. By using the technology present at our disposal we have designed a data acquisition system which will help the farmers acquire data about their field without physically present over there. Not only can the farmers acquire information, they can also control the various parameters of the field like starting the motor so that the water can again be fed to the fields in case of scarcity in the moisture content of the field. This can all be done without being physically present at the fields.

II. BLOCK DIAGRAM

The block diagram of the wireless data acquisition and control system is as shown below.

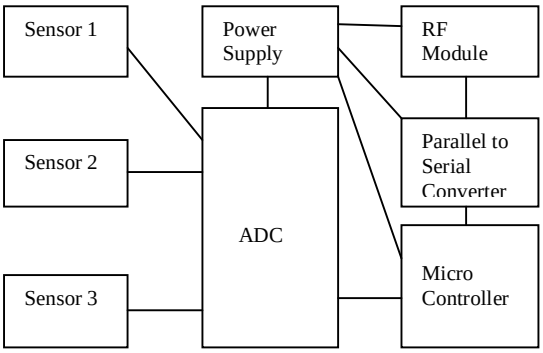

Fig.2 Transmitter Section

The above diagram i.e. **Fig.2** represents the transmitter section of the Wireless Data Acquisition and Control System. This section is basically used for transmitting the acquired the information and data from the site under observation. The analog acquired from the site under observation is transformed into digital data by the transmitter section. The various modules of the transmitter section represented in **Fig.2** are enlisted below:-

1. Sensor Modules
2. Power Supply Module
3. Analog To Digital Converter(ADC)
4. Microcontroller
5. Parallel to Serial Converter
6. Radio Frequency Module (RF)

The Sensor Module represented in the transmitter section senses the analog information that we want to acquire from the place under information. It senses data such as the moisture level using the moisture sensors, adequate temperature can be sensed using temperature sensors, the necessary pressure readings and statistics can be gained using pressure sensors or actuators. The sensors are basically transducers that convert the analog signal or information into electrical form or in a form i.e. compatible with the system so that it can process it further successfully.

The Power Supply Module i.e. shown in the transmitter section provides the whole circuit with the necessary voltage required for its functioning. The necessary power that each module or component requires in the circuit is given by the Power Supply Module. In simple terms it provides power to the circuit components and modules.

The Analog to Digital Converter Module basically works on the principle as suggested by its name. The analog data sensed by the sensors is converted into an electrical signal having very low power. This data cannot be sent to the receiver as it is. It has to be converted into digital form i.e. suitable for the transmission of information from the transmitter to the receiver of the system. So the Analog to Digital Converter Module converts the analog data sensed by the sensors into digital form which is suitable for processing of information.

The Microcontroller Module present in the transmitter section controls the function of each block in the circuit. It is used for the processing of the information which is given to it in the digital form from the Analog to Digital Converter.
The microcontroller consists of a program which gives it the instruction about what operations that it has to carry out on the information that is been given to it for processing. The microcontroller uses 5 volts for its functioning.

The Parallel to Serial Converter Module gets the processed data from the microcontroller section of the transmitter. This information received by the parallel to serial converter is not in a compatible form that can be sent successfully to the receiver section. It converts the information received by it after processing and converts it into serial data which is compatible to the transmission successfully.

The Radio Frequency Module is the transmission module which makes our system wireless. The information gained from the parallel to serial converter is converted into radio waves of a particular frequency in the allotted bandwidth and sent through the communication medium towards the receiver section. There are various other methods using which we can make the system wireless. There are various other techniques or alternatives to Radio Frequency Module. The other alternatives to RF module are Bluetooth, Wi-Fi, GSM etc.

These can be implied to the system for transmission depending upon the distance that the information has to travel.

This transmitter section that we are going to construct is going to be designed using the LEGO technology that we have introduced in the prior part of this document. We would be designing specific modules of the components represented in the transmitter diagram. Different modules of Sensors, ADC, Power Supply, Micro-Controllers and RF modules will be designed. These modules will be connected to each other using connectors. These modules can be easily disconnected and again connected together as per the application for which we are going to use it for. This makes the system easy to assemble and disassemble.
The signal or the information transmitted from the transmitter section of the Wireless Data Acquisition and Control System is sent to the receiver section which receives the data or the information i.e. transmitted. Now let us see the receiver section block diagram.

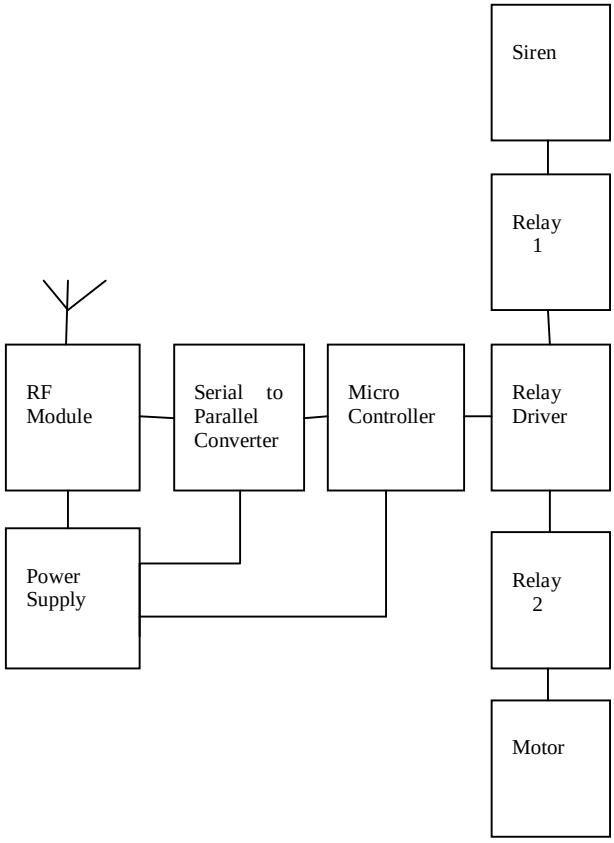

Fig.3 Receiver Section

The function of the receiver section is to receive the information that the transmitter section has sent and process the information accordingly and carrying out the necessary functions and taking the necessary measures as the processed information directs. The receiver section shown in **Fig.3** consists of a number of modules. The various modules present in the receiver section can be enlisted as follows:-

1. Radio Frequency (RF) Module.
2. Serial to Parallel Converter Module.
3. Micro Controller Module.
4. Relay Driver Module.
5. Power Supply Module.

The Radio Frequency Module that was present in the transmitter section is also in the receiver section to receive the information from the transmitter. The Radio Frequency Wave received by the RF module is given further ahead to the other modules for processing so as to get necessary actions done as per the requirements mentioned in the transmitter section.

The Serial to Parallel Converter Module converts the serial data received at the receiver into parallel form. This data is converted into parallel form as the serial data cannot be processed by the microcontroller.

The Microcontroller Module is used to process the information that is received at the receiver of the system. It is used for the processing of the information which is given to it in the digital form from the Analog to Digital Converter. The microcontroller consists of a program which gives it the instruction about what operations that it has to carry out on the information that is been given to it for processing. The microcontroller uses 5 volts for its functioning.

The Relay Driver Module is used for the switching purpose. Let us take an example of the farm that we had taken earlier. Suppose that the transmitter transmits that the moisture content in the soil of the farm is less and needs to be rejuvenated. The transmitter sends the information to the receiver about the moisture content in the soil, this information is processed by the microcontroller as per the program stored in the memory. The processed information is given to the relay driver which is given the order to switch on the motor so that moisture content in the soil is maintained. This how the Data acquisition and control action takes place. This was just the example of the moisture content control we can easily control and acquire data about other such necessary parameters that are needed to be understood.

The Power Supply Module provides the whole circuit with the necessary voltage required for its functioning. The necessary power that each module or component requires in the circuit is given by the Power Supply Module.

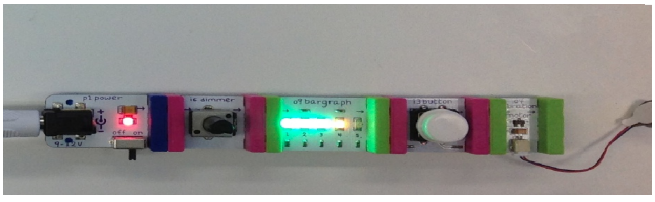

Fig.4 Electronic Modules connected with the help of connectors (Little bits)

III. MODULE DESIGN

The designing part of these modules that are required for the construction of the system that we have mentioned above depends on the creation of the modules that we are constructing. These modules that we are creating are classified into four categories that are shown below:-

1. Input Modules.
2. Transform Modules.
3. Output Modules.
4. Power Modules.

The Input Modules that are to be designed function in the form of converting the analog information, signal or data into a form that is compatible for the circuit to process and transmit. The Input Modules comprises of the sensor modules that sense the analog information, the Microphone module, Light Module, Sound Module.

The Transform Modules comprises of the keyboard modules, the motor control modules i.e. the relay driver that controls the switching of the motors according to the action that the system demands as per the surveillance carried out at the receiver. It basically is used for the control application in the system. The prototype of the electronic modules that will be created using the connectors so that the modules can be connected to form the desired systems as required.

The Output Modules includes the Light Emitting Diode (LED) module, Buzzer Module, LCD Module, Siren etc.
These modules are designed to display the output that the system processes and the response that the system has to offer.

Including these modules mentioned, there are other modules that are necessary for the system construction. The modules that will be designed are constructed and designed according to a specific protocol. A specific rule is going to be followed so that the modules connect properly to each other and the voltage and current levels of the circuits or the modules are maintained so that they can be used with flexibility.

IV. RESULTS

From all the research, analysis and discussion that we have done so far we can conclude that the LEGO technique is definitely the need and the update to all the out dated

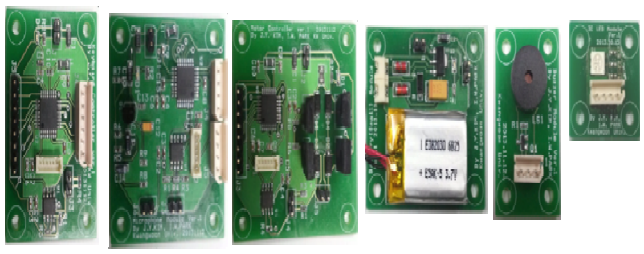

Fig.5 Basic Prototypes of the Electronic Modules

Experimental kits that are being used in the educational institutions besides this it will provide the power of electronics to every common person who doesn't have the core knowledge of electronics. As far as wireless data acquisition is concerned, this system has an advantage of using both GSM technologies which there by eliminates the cost of network usage to a great extent. Thus by going through all the problems and project is practically implemented and it is feasible, brings into focus the future direction of water management which is our main requirement.

V. CONCLUSIONS

The discussions made earlier can be concluded by saying that the LEGO technique is the new and updated method of learning electronics. It makes you understand the working principle of all the components and the various concepts of electronics in a better way in comparison to the traditional techniques or methods that we have been using till date. In simple language as we say that with time you should update yourself so that you can learn better and actually understand what you are trying to learn.

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