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Track 'N' Sense – Bluetooth Based Cargo Environment Sensing, Tracking And Identifying Device

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Abstract - Track N Sense device which is designed to help the customer to decide the acceptance and goodwill of product. The information stored in this device should be sent to the costumer end. PCB of the device is designed and fabricated. Code is developed in MPLAB, to set the working of the device. It also improves customer satisfaction. Primarily Temperature and Humidity needs to be controlled by the Transporter so that these perishable products have longer life and retain their original properties. Sensors actively monitor the transport conditions and store the readings on an on-board EEPROM. At the end of the transit the contents from the EEPROM can be transferred to the User's PC. The system will also house a Bluetooth module to perform these tasks. Using MIP App Inventor application is developed a per our need, how it should behave, how it should look. It helps to receive data and store data in excel sheet. It I used for short range transmission with the help of Bluetooth.

Keywords: Track 'N' Sense Device, Temperature Sensor, Humidity Sensor, Bluetooth, Cargo Environment, Cold Chain Logistics, Perishable Goods, EEPROM, Cargo Monitoring, MP LAB, MIT App Inventor.

1. INTRODUCTION

The trackers are a comparatively new product and the concept is just entering the market to get an aware on this product to costumers. The growth of Bluetooth Low Energy (known as BLE or Bluetooth 4.0) really created us a way to do some productive things using these Bluetooth devices. Now instead of just the old attaches (like Bluetooth headsets, speakers, and computer peripherals) manufacturers can also use this Bluetooth into any tiny devices that can survive which small battery which does not required any back up, external rechargeable circuit or battery swap.

One of the applications of tracker in existing system is Bluetooth tracker. These trackers are small in size which can be attached to our household things which we search more in our day to day life, like keys, purse or any other objects which we wish to track. The tags are linked to your smart phone through Bluetooth and form a radio-based link between us and our object. Now a days we greatly rely on Cold Storage providers to transport Expensive medicines or Special Environment plants or food grade supplies to various geographies of the world. During transit it is the responsibility of the transporter to maintain the well-being of the item maintaining proper environmental conditions like temperature and humidity to keep up with the original quality of the expensive and sensitive items. Currently there is no way to crosscheck whether the transporter has actually fulfilled their promise of keeping the environment conditions desirable for our packages.

In this paper we have developed a product that will help both transporters and the customers. For the transporter it helps to maintain goodwill and to provide proof of quality of transportation environment encountered by the cargo to the customer, using the Track 'N' Sense. It also improves customer satisfaction.

2. PROPOSED METHODOLOGY

In many cases, the temperature is the most important factor when prolonging the practical shelf life of perishable food products. Sensors actively monitor the transport conditions and store the readings on an EEPROM where the data will be stored for the entire transit time. At the end of the transit the contents from the EEPROM can be transferred to the User's PC where an entire report plan of the transit can be dumped showing exactly any of the aberrations (if any).The system will also house a Bluetooth module dump the EEPROM details to the Users System – Mobile[1].

3. EXISTING SYSTEM

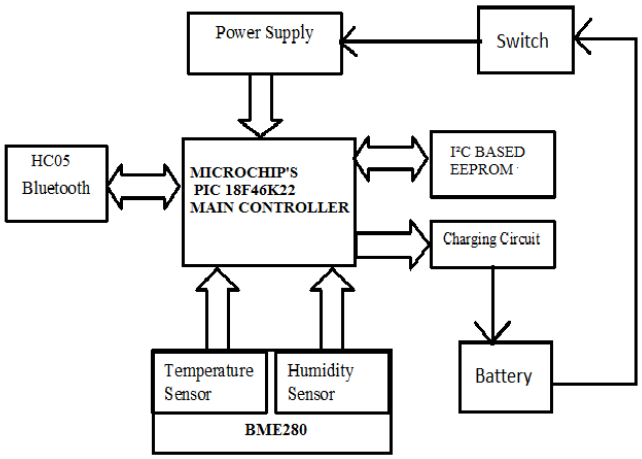


Fig 1: Block diagram of Track 'N' Sense device

The block diagram of Track 'N' Sense device and is as shown above. Here PIC 18 is used as a controller because of its advantage that is low cost. It has 5 ports, each has one register RA, RB, RC, RD, and RE. It is 40 pin devices in these 36 pins are in use. 35 pins are used as both input and output and one pin used only as input[2]. Track 'N' Sense is used during transportation. Main task of the transporter is to maintain the goodwill of the product. For the client it should be shown with the proof, which is done by the Track 'N' Sense device. The task of the PIC 18 is to store data into EEPROM for every one minute and once the transporter reaches the client the data stored in EEPROM is transferred to use the device – mobile phone through Bluetooth. To get the over phone application is developed using MIT app inventor.

PROPOSED SYSTEM

EEPROM

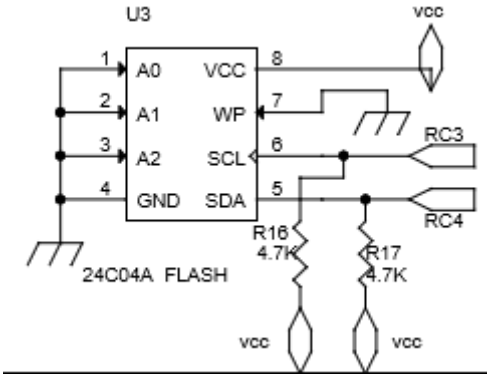
The Microchip Technology Inc. 24C04A is a 4K bit Electrically Erasable PROM. The gadget is sorted out similarly as with a standard two wire serial interface. Progressed CMOS innovation permits a significant decrease in control over NMOS serial gadgets. Extraordinary component gives equipment compose insurance to the upper portion of the square. The 24C04A has a page compose capacity of up to eight bytes, and up to four 24C04A gadgets might be associated with a similar two wire transport.

In EEPROM data stored separately and it doesn't belong to either to data memory or program memory. It is an nonvolatile memory array, the data stored in this is long term for program data. The information in this are addressed indirectly through special function register. During normal operation EEPROM is both readable and writable.

There are four SFRs to write and read data to or from EEPROM respectively

- EECON1
- EECON2
- EEDATA
- EEADR
- EEADRH

EECON1 and EECON2 are the two registers which controls the access of data stored in EEPROM.
EECON1 register acts as control register for data memory and program memory.



EECON1: DATA EEPROM CONTROL 1 REGISTER

R/W-x	R/W-x	U-0	R/W-0	R/W-x	R/W-0	R/S-0	R/S-0
EEPGD	CFGS	—	FREE	WRERR	WREN	WR	RD
bit 7							bit 0

bit 7

EEPGD: it helps in accessing Data and program EEPROM Memory
If 1 it access program memory
If 0 it Access data EEPROM memory
bit 6

CFGS: it helps in selecting Flash Program, Data EEPROM or Configuration
If 1 we can access Configuration registers
if 0 we can access Flash program or data EEPROM memory
bit 5

Unimplemented: it is set to '0'
bit 4

FREE: Erase Enable bit

If 1 it erases the program memory block which is addressed by TBLPTR
If 0it only Perform write operation
bit 3

WRERR: Flash Program or Data EEPROM Error Flag
If 1 A write operation is prematurely terminated
If 0 the write operation completed
bit 2

WREN: Flash Program/Data EEPROM Write Enable bit
If 1 it allows write cycles to Flash program/data EEPROM
If 0 it inhibits write cycles to flash program/data EEPROM
bit 1

WR: Write Control bit
If 1 it initiates an EEPROM read
If 0 it does not initiate an EEPROM read

Reading the data from EEPROM

To read data from EEPROM register address should be written in EEPROM REGISTER and EEPGD should be cleared. RD bit should be set, by setting all these in prior we can read data in next instruction. This register holds the data until the other read operation occurs.

Writing the Data to EEPROM Memory

Writing to EEPROM is easier than reading operation. In this address should be written first in EEPROM register and then write data into EEPROM register by Making EECON1 as 0AAh, and we should set write bit.

UART

The Universal Asynchronous Receiver Transmitter (UART) module is a serial I/O Communications peripheral. Apart from the program execution it consists of clock generators, shift registers and data buffers which are used for transmission and reception of data. The UART, also known as a Serial Communications Interface (SCI), it can be configured as a full-duplex asynchronous system.

There are three registers which are used to control the operations of UART

- Transmit Status and Control (TXSTAx)
- Receive Status and Control (RCSTAx)
- Baud Rate Control (BAUDCONx)

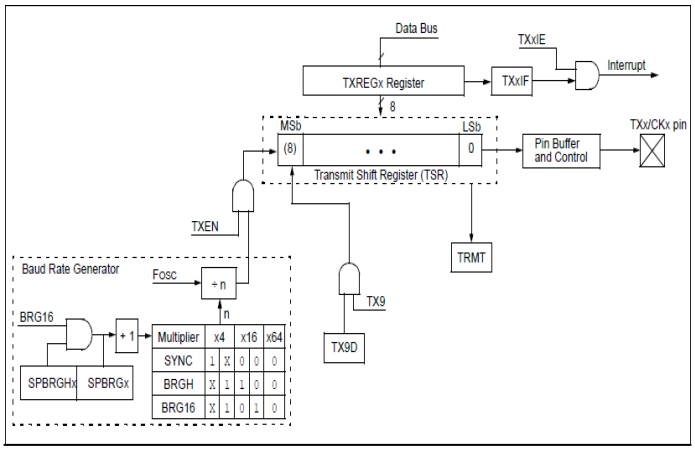


Fig 2 : Transmission block diagram

The transmission process starts with sending the starting bit to TXSTAx, if it is the 1st bit in transmit state and control register then that1st bit will be sent to TSR register. If previously sent bit is still in TSR register then TXSTAx register will wait until the transmission of the previous data is completed. Once it is completed by sending stop bit, the 1st bit of transmission is followed by stop bit.

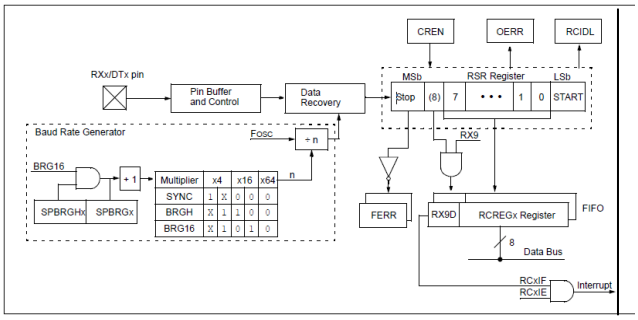


Fig 3 : Receiver block diagram

First bit which is ready to receive is also known as start bit, It is always a zero. After receiving the 1st bit as zero, it starts receiving the data until it receives '1' which is an stop bit. Once the reception is done completely and the stop bit is received, the stored data in RSR register is then sent to UART.

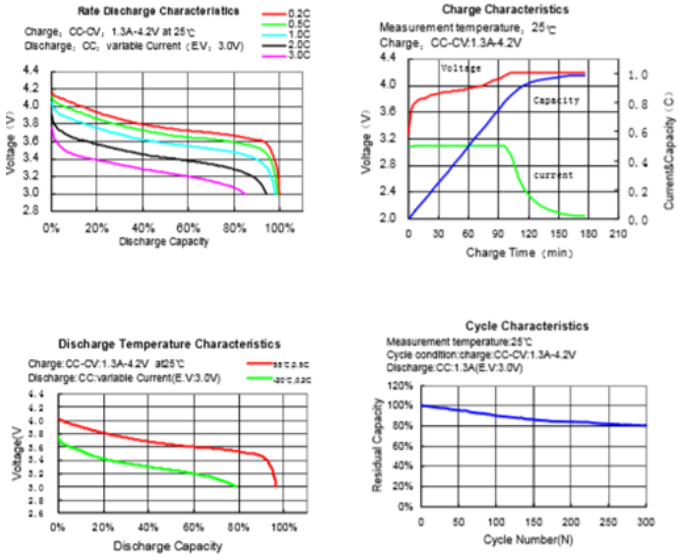
BATTERY

Cylindrical lithium ion rechargeable cell battery is used in our project its model number is LIR18650 which has battery capacity of 2600mAh

CHARACTERSTICS OF LI-ION BATTERY

1 Capacity（25±5℃）	Nominal Capacity：2600mAh (0.52A Discharge, 2.75V) Typical Capacity：2550mAh（0.52A Discharge, 2.75V） Minimum Capacity：2500mAh (0.52A Discharge, 2.75V)
2 Nominal Voltage	3.7V
3 Internal Impedance	≤ 70mΩ
4 Discharge Cut-off Voltage	3.0V
5 Max Charge Voltage	4.20±0.05V
6 Standard Charge Current	0.52A
7 Rapid Charge Current	1.3A
8 Standard Discharge Current	0.52A
9 Rapid Discharge Current	1.3A
10 Max Pulse Discharge Current	2.6A
11 Weight	46.5±1g
12 Max. Dimension	Diameter(Ø): 18.4mm Height (H): 65.2mm
13 Operating Temperature	Charge: 0 ~ 45℃ Discharge: -20 ~ 60℃
14 Storage Temperature	During 1 month: -5 ~ 35℃ During 6 months: 0 ~ 35℃

PERFORMANCE OF THE BATTERY



4. PCB DESIGN AND FABRICATION PROCESS

A PCB is a printed circuit board, and it also called as a printed wiring board. It is mechanically emphasizes and electrically relates electronic fragments or electrical sections using conductive tracks, pads and distinctive features cut from no less than one sheet layers of copper overlaid onto or possibly between sheet layers of a non-conductive substrate. Parts are generally bound onto the PCB to both electrically relate and mechanically append them to it. Printed circuit sheets are used as a piece of everything with the exception of the most forthright electronic things. They are moreover used as a piece of some electrical things, for instance, uninvolved switch boxes.

Different alternatives to PCB`s join wire wrap and point-to-point advancement, both once surely understood yet now and again used. PCBs require additional arrangement push to spread out the circuit, anyway buildup and assembling can be robotized. Specific CAD writing computer programs is available to complete a critical piece of design. Making more number of PCBs which helps in decreasing expense and furthermore speeder than the other wiring procedures, as parts are mounted and wired in one action. Considerable amounts of PCBs can be made meanwhile, and the outline simply should be done once. PCBs can in like manner be made physically in little sums, with diminished favorable circumstances.

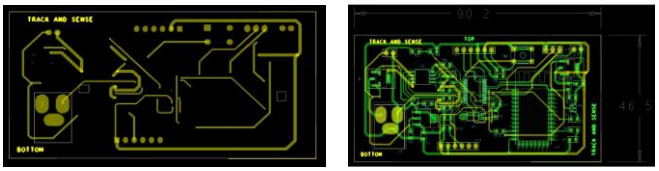


Fig 4 : Manufactured PCB

5. SOFTWARE REQUIREMENTS

- MP LAB IDE
- MIT App Inventor

MPLAB Compiler for PIC18 Microcontroller:

MPLAB C18 compiler is a full-included ANSI consistent C compiler for superior PIC18 8-bit microcontrollers. The 32-bit Windows support application is a completely incorporated segment of Microchip's MPLAB IDE, permitting source level investigating with the MPLAB ICE, the MPLAB ICD 2 and the MPLAB SIM Projects. Compiler switches and linker customizations ought to be conceivable absolutely inside MPLAB IDE to give a full graphical front end to this extraordinary compiler. Watch windows indicate information structures with characterized information writes, including skimming point

Features:

1. It is compatible with ANSI version 89
2. For a project management and debugging of source level MPLAB IDE integration is easy.
3. Even if the object is relocated the code which is generated by this MPLAB is reusable.
4. When external memory is used while writing code read and write memory locations are transparent.
5. Support for inline assembly is strong whenever the control necessary.
6. Engine which is used for code generator which is optimized with multi-level.
7. The libraries supported by MPLAB includes PWM, SPI, I2C™, UART, USART, string manipulation and math libraries.
8. user will have control over data and code memory allocation.

9. Supports both a small (16-bit pointers) and a large (24-bit pointers) memory model for efficient use of memory.
10. MPLIB library allows easy use of included libraries and for user created libraries.

MIT App Inventor

MIT App Inventor utilizes the small building blocks to construct the programming application. Everything in the Blocks palette under Built-in is viewed as a cabinet. The drawers contain the pieces which are puzzled. Even if it looks simple in the beginning which we have started with small projects, we can develop complex projects by using the puzzled blocks. To better comprehend what programming an application involves, it is helpful to know what is happening inside an application.

App Inventor is a free, cloud-based administration that you get to utilizing an internet browser Log in with a Google account (Gmail or school email attached to Google) to begin imagining immediately. MIT App Inventor is an online instrument for building Android apps. This is frequently alluded to as visual programming, which implies the client can perform programming errands without entering any PC code. Application Inventor is effectively overseen and created by MIT's Mobile Learning Lab. App Inventor is developing in prominence among instructors as an approach to present those with no programming background to the standards of software engineering and application improvement. It likewise fills in as an extraordinary initial step for those fiddling with programming or hoping to expand their insight into how cell phone applications function.

6. RESULTS

The Hardware set up is as shown in fig2 stores the data in it,in PIC 18 it has EEPROM in it. The stored data will be transferred to phone using MIT App inventor we developed app and data will get transferred to phone through Bluetooth and stored in excel sheet. It is as shown below.

Outer view of app

Fig 5. Before and after connecting to bluetooth

Fig 6. When clear and write data button is pressed

Fig 5-8 shows the outlook of the app in different stages over mobile phone. As shown in fig5 it tells how it'll be before connecting to Bluetooth and after connecting to Bluetooth , it has an indication Bluetooth connected. In fig 6 by pressing clear data, it clears the previously stored excel sheet data. My clicking write data button it starts storing data with the given interval of time into EEPROM.

Fig 7. When stop and get data button is pressed

In fig 7 once the stop command is sent it stops storing the data into EEPROM, by clicking get data button the data stored in EEPROM will be sent to phone. Now that data will

be sent to Excel sheet as shown in fig 8. The button called parcel identity will tell the product that is imported.

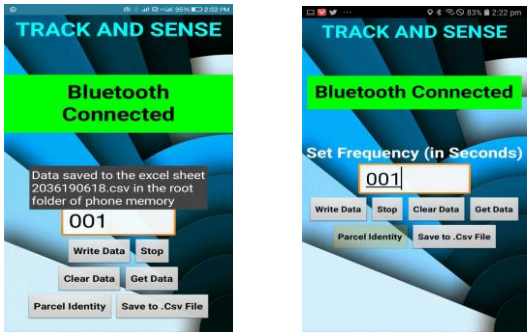


Fig 8. Save and parcel identity button is pressed

Fig 9: TRACK N SENSE DEVICE

Date	Time	Temperature in °C	Humidity in %(RH)
230518	1423	28	52
230518	1425	28	52
230518	1427	28	52
230518	1429	28	52
230518	1431	28	52
230518	1433	28	52
230518	1435	27	52
230518	1437	27	52
230518	1439	27	52
230518	1441	27	52
230518	1443	27	52
230518	1445	27	52
230518	1447	27	52
230518	1449	27	52
230518	1451	27	53
230518	1453	27	52
230518	1455	27	52
230518	1457	27	52
230518	1459	30	49
230518	1501	30	49
230518	1503	30	49
230518	1505	30	49
230518	1507	30	49
230518	1509	30	49
230518	1511	30	49
230518	1513	30	49
230518	1515	30	49
230518	1517	30	49
230518	1519	30	49
230518	1521	30	49
230518	1523	30	49

Fig 8 Excel sheet output

7. CONCLUSION

In this paper Track N sense device was designed using a PIC18 Microcontroller, HC-05 Bluetooth device, BME280 Sensors which when senses the temperature and humidity values of the surrounded environment where the device is placed, this helps us in having a complete record of those two measurements throughout transportation as shown in fig 8. And on the other end the Android app is developed using MIT App inventor. Data stored in EEPROM can be displayed over phone using the app developed. During transportation there will be no guarantee that the product is maintained at its original specifications. Once we receive the product from the transporter it is on our risk whether the product is in good condition or not we need to pay for it. Hence Track 'N' Sense device helps to overcome all these problems, by knowing the measurements values in prior.

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