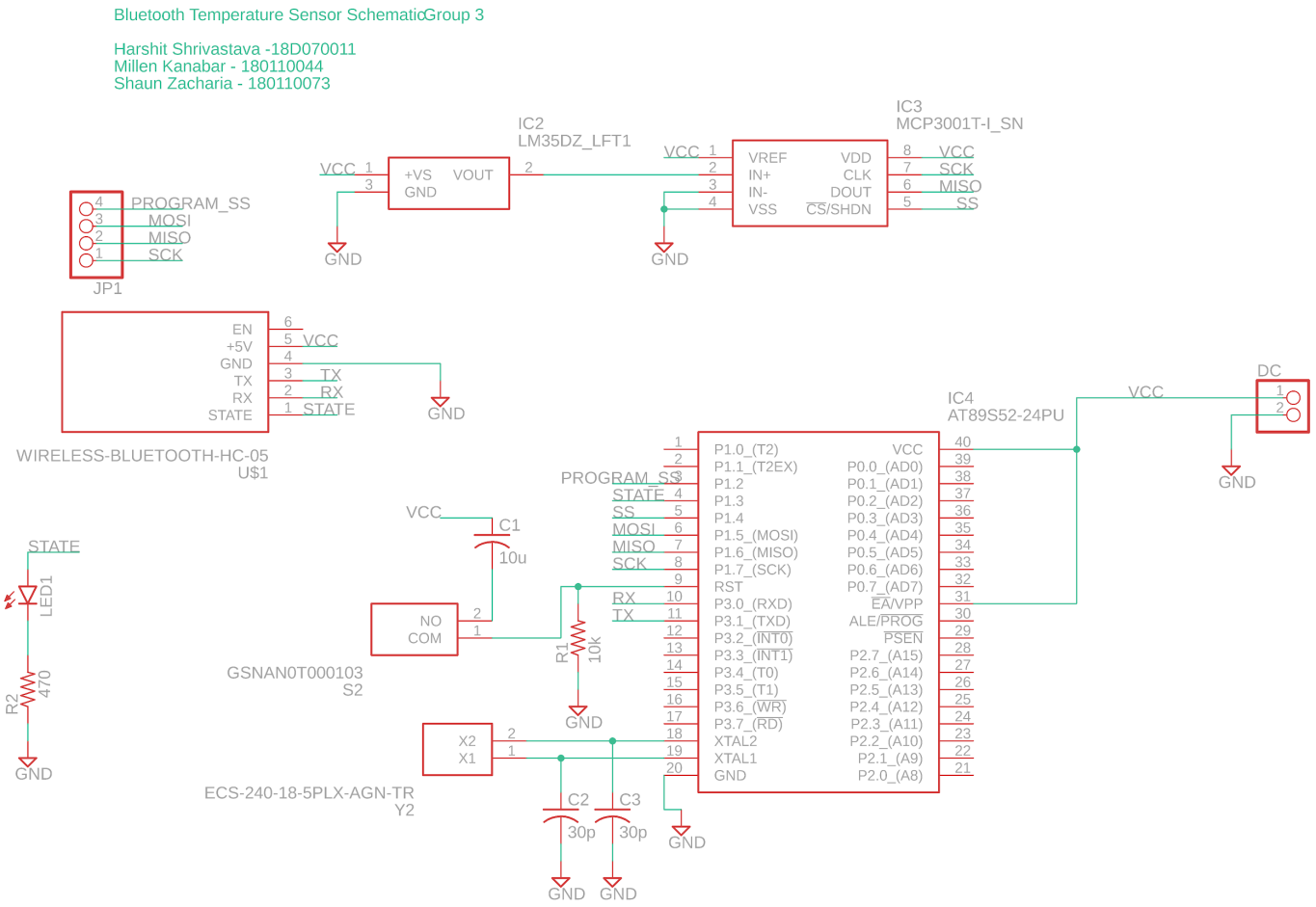
MID-PROJECT REPORT

EE 344 - Electronics Design Lab



Group 3

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PROBLEM STATEMENT

To design a module that senses the temperature and sends the readings every minute to a bluetooth-enabled device. In case of disconnection, the module will store the readings in its memory till connectivity is regained, for a period of one day. The module can also be modified to accommodate another application, such as temperature control, by appropriately programming the internal microcontroller.

SELECTION METHODOLOGY

The components for our project were selected based on the following arguments

1. **Temperature Sensor:** We first selected the sensor we'd use for reading the sensor. This was based on the accuracy and the performance parameters we required. For the application we have considered, the LM35 temperature sensor is reliable and accurate enough, along with the benefit of being inexpensive.
2. **Analog to Digital Converter:** The single-channel MCP3001 is a well-known analog to digital converter, which allows seamless integration with the microcontroller. The bit resolution also allows for us to monitor the temperature with reasonable accuracy.
3. **Microcontoller:** The microcontroller is the focal point of the circuit, interfacing with the measurement and the transmission circuitry and storing the data in case of disconnection. We have selected the Atmel AT89S52 because it is a tried-and-tested microcontroller that satisfies our requirements, is familiar to us and is also largely inexpensive. Having a microcontroller this versatile also allows the module to be used for other applications along with data transmission, such as active temperature control. A few of the components whose need arose specifically to get the microcontroller running are enumerated below.
    a. **Crystal Oscillator:** This is needed to provide a clock to the microcontroller, and the need for this is also mentioned in the datasheet of the microcontroller. We selected a reliable 25 MHz crystal oscillator to provide these for the microcontroller.
    b. **Switches:** The switches are needed for putting the microcontroller in bootloader mode and resetting the microcontroller.
4. **Bluetooth Module:** The bluetooth module was chosen such that it would have a good enough range to work as a home appliance, as well as has a price that is low enough so that the system would work well as an overall product.

5. **External Memory:** We ended up deciding to not use external memory for our system as the update rate that we intend to provide is 1 temp reading/min. At that rate, while transmitting a float-type integer, we can buffer up to an hour's worth of data, even if the system loses connection if we simply use the microcontroller's internal memory alone.

DESIGN CONSIDERATIONS

- We chose loading capacitors for the oscillator as per datasheet.
- The values of resistance and capacitance next to reset switch were chosen such that charging time is more than 2 oscillator cycles of the clock, which was needed so that the microcontroller gets reset.
- An LED was placed that tells the user whether the device is in paired state.
- We need to add connections so that functionality for programming the microcontroller

BILL OF MATERIALS

COMPONENT	PRICE (RUPEES)	DETAILS	LINK TO MARKETPLACE
LM35	150	Temperature Sensor	LM35 Mouser
MCP3001	127	10-bit resolution 1 channel ADC	MCP3001 Mouser
AT89S52-24PU	200	8051 microcontroller	Microcontroller Mouser
ECS-240	25	25 MHz crystal oscillator	Crystal Mouser
GSNAN0T000103	22	Tactile Switches	Switch Mouser
HC-05	380	Bluetooth Module	HC-05 Amazon

REFERENCES

Datasheets of the above mentioned components

PROJECT PROGRESS LINK

All progress of the project is tracked in the following GitHub repository: https://github.com/ShaunZac/EE344-Group-3-2020