"Karen" Project – Detailed view (v1)
By Bill Weis

Requirements:
1. Evaluate the benefit of having control over the Medical MedAir Low Air Loss Mattress Replacement System with Alarm, 8" with Quilted Cover Fully Digital with Remote Control

Solution – High Level:
1. We created a voice solution as well as a solution where commands could be "clicked" on in a browser

Details of the Solution

1 – Adding voice or other controls to the Medical MedAIR Low Loss Mattress – First, here are the features of the product as posted to Amazon:

- NYLON TPU CELL, QUILTED TOP COVER
- ULTRA QUIET PUMP: This hospital grade air mattress has an ultra quiet air pump that operates at less than 20 dB. Dual pump cores provide maximum output and an easy to use digital adjustment. Our digital pump with diagnostic alarms allows customization to individual patients' needs.
- SAFE, FAST & EASY: This mattress and pump system is simple to use and inflates quickly. Uses an intuitive digital LED screen that displays weight and pressure. This product also contains ab emergency CPR function that lets you deflate the mattress within a second by pulling the red tag.
- LOW AIR LOSS: Cell-on-cell design of 8″ deep air cells prevents "bottoming out" and provides up to 24 hours of power outage protection. There is also a pillow function that maintains the air in the 3 cells at the head of the bed to ensure patient comfort in static mode.
- HOSPITAL GRADE NYLON COVER: The removable quilted poly PU cover ensures premium patient comfort. It is water resistant and easy to clean and maintain. The cover has an anti slip coating, and attached to the bed frame with adjustable straps.
- THE PERFECT SIZE: "80″(L) x 36″(W) x 8″(H) This mattress was designed to fit most hospital beds. The mattress is 8" high and has a weight capacity of 450 pounds.

The features you see on the front panel are shown below:

There are indicators for normal and low pressure, a panel lock feature, Seat Inflating, Auto Firm, Alarm/Alarm reset, Cycle settings for 6,9,12 and 25 minutes, a Static button, and the ability to set the weight of the person on the mattress.

The hand remote transmits an Infrared code for each of the buttons on the remote. Since the remote lacks a button for Alarm Reset and for the Static feature, we are unable to remotely control those features with our solution.

There is a drawback to using Infrared transmission between the remote and the control panel. Firstly, infrared is very directional, so you have to point the remote to the face of the front panel. This means if the person lying on the mattress wanted to control the mattress settings, the remote would not work if the control unit was hung on the foot of the bed since the infrared signal will not be sensed by the control unit when pointed at the backside. Secondly, the control panel automatically goes into a Panel Lock state every 2 minutes, so even if the person lying on the mattress could control the unit, they would have to guess if panel lock was on or off when switching to other features. The only way solution to this would be to hang the control unit on the wall which may or may not work well given the layout of the room.

After capturing the infrared signals for each of the buttons on the remote, we built a solution that allows for control by voice as well as a solution where a browser would have the various commands and someone could control the unit by clicking links.

The solution is based on an ESP8266 microcontroller.
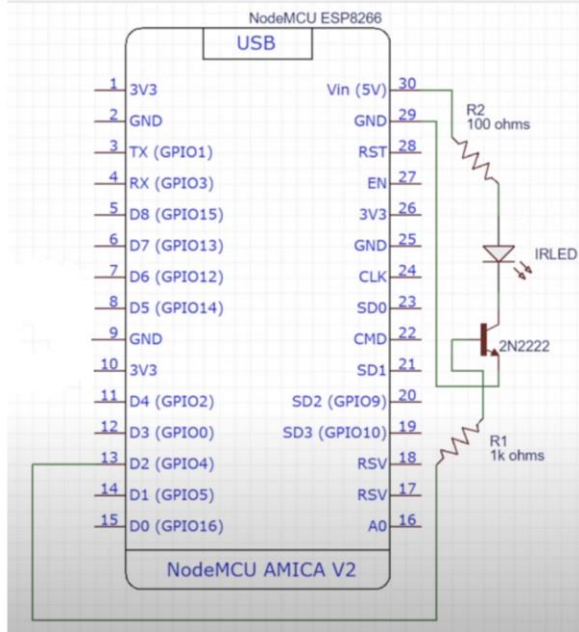
IR Code			
Seat Inflating	FF40BF	FFFFFFFF	NEC
Auto Firm	FFA05F	FFFFFFFF	NEC
Lock	FF609F	FFFFFFFF	NEC
KG+1	FF10EF	FFFFFFFF	NEC
KG+10	FF906F	FFFFFFFF	NEC
KG-1	FF30CF	FFFFFFFF	NEC
KG-10	FFB04F	FFFFFFFF	NEC
Cycle Time 6	FF6879	FFFFFFFF	NEC
Cycle Time 9	FF48B7	FFFFFFFF	NEC
Cycle Time 12	FFA857	FFFFFFFF	NEC
Cycle Time 25	FF8877	FFFFFFFF	NEC

Here is a picture of the solution. This small enclosure contains the ESP8266 and the tube along the left side has the discrete components shown above including the infrared emitter mounted near the top of the tube. This unit is attached to the front panel via valcro.