

CGK - Community Gate Keypad

Requirements Definition Document

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Team 03

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1 Introduction

B-STACK is a software design group consisting of Brandon Stringham, Shreeman Gautam, Tanner Hunt, Cody Crane, Amun Kharel, and. This team is tasked with developing a keypad control system for a vehicular access gate. The gate control keypad allows access into a gated facility via a code. It is a security software and hardware implementation that will communicate with the gate software system to allow access and to inform users of the keypad system messages via LCD display.

The objectives section explains the three key major components in the design of the gate control keypad. The system organization section shows a visual layout of the system interacting with the user, keypad, and gate systems. The capabilities section outlines all the features of the keypad system from the keypad layout, to the code access procedures, the interactions between keypad and the gate, and the interactions between the keypad and the user via LCD display. Finally, the constraints of this keypad system will be the environmental factors that will not affect the system.

2 Objectives

Regarding the keypad system design, the team is looking to meet several objectives such as security, convenience, and consistency.

The first objective is to deter unauthorized access. The system does not allow in people who do not have the correct code. This objective leads to the ability to change codes periodically so that bystanders cannot watch the code and have access through the gate. Also, to prevent malicious actors from brute-force guessing the code, the keypad will have a cooldown period after several incorrect codes have been entered.

The second objective is convenience. The system is quick and easy such that many users input their codes and get through the gate without incident. This objective leads to requirements such as a commonly used 12-digit keypad, and a simple LCD display to inform the user with simple messages.

The third objective is consistency. To avoid the scenario of users getting stuck outside in frustration, the system acts the same every time such that users can quickly

enter through the gate. This objective requires that this team builds a simple product that is reliable and not overly complicated.

3 System Organization

Figure 1 is a pictorial design of the system organization of the keypad control system installed in a two-lane wide community access gate with an existing gate controller system.

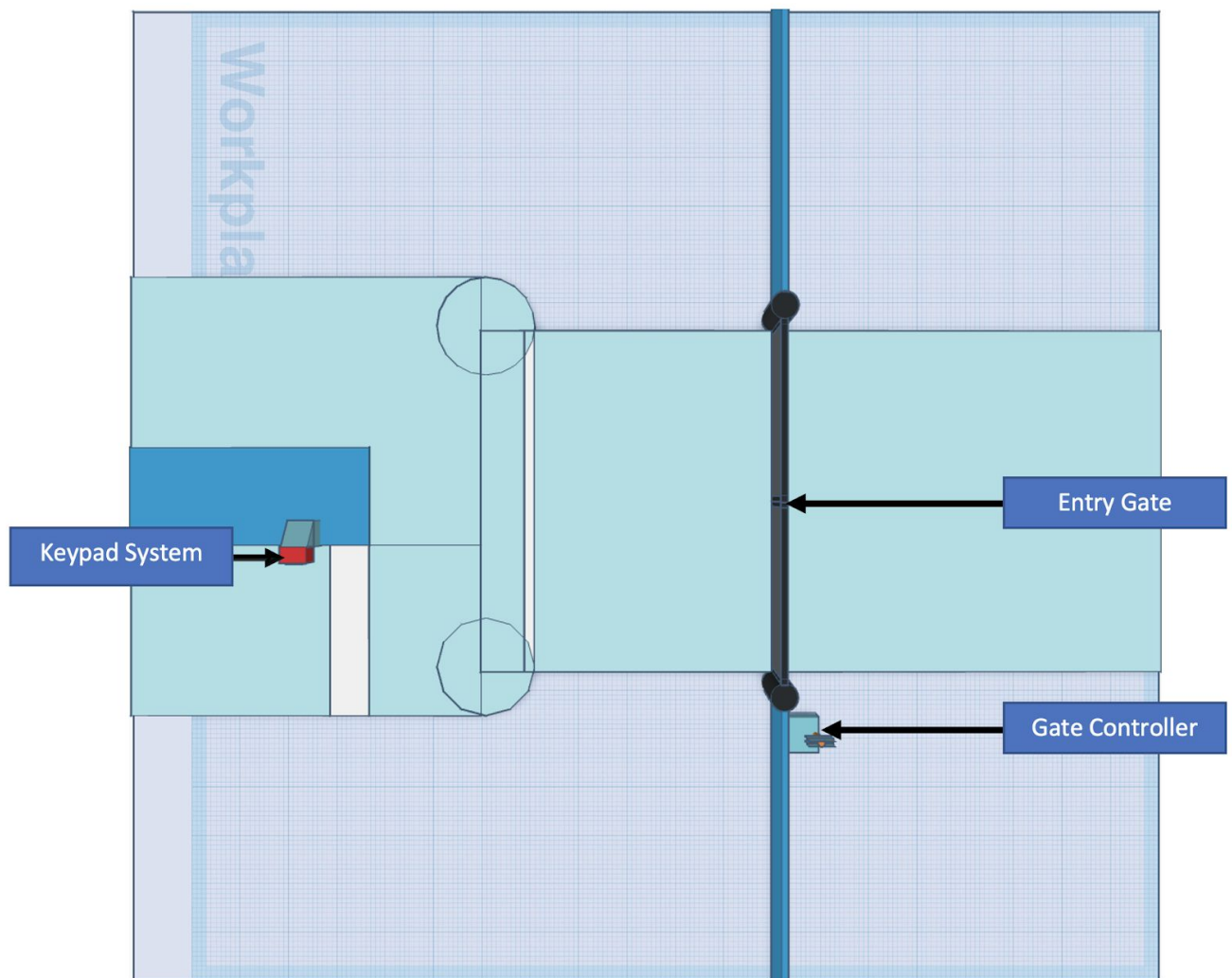


Figure 1 System Overview

The keypad is to be placed outside the gate. It is accessible from the driver side window of most vehicles attempting entry into the facility. Underground wiring is installed in order to facilitate one-way communication from the keypad to the gate controller. The user exits the facility through the same gate, which is controlled by the gate controller using proximity or other sensors.

Due to the limited functionality of the keypad, the gate controller handles most of the gate operation, such as opening the gate for exiting vehicles and deciding when the gate can be safely closed without obstruction. These operations are facilitated via sensors and hardware that may be included in the gate controller system. Using Figure 1 as an example, the gate controller utilizes proximity sensors to detect obstructions and uses pressure sensors to open for exiting vehicles.

4 Capabilities

The keypad consists of 12 buttons in a 4 by 3 grid: (1,2,3), (4,5,6), (4,8,9), (*,0, #). It is designed to open a gate by communicating with the gate controller and can be used with most facilities that need a secure entrance onto their property.

There are 3, four-digit numeric codes: one for the administrator of the keypad system, one for the users, and one for public service personnel. The administrator code will not change and is defined on installation i.e., it comes with the keypad. In the event the administrator code is lost, the keypad system will need to be reset. The user and public service codes can be changed without a reset, by the administrator. After admin code is entered, the admin is prompted to select the code that they would like to change. New codes must not be the same as the previous 3 codes. The admin code is only used for changing the codes and does not by itself open the gate.

The keypad system has the admin code, the current user code and public service code, and the previous two codes for the users and public service individuals. The codes, 7 in total, are permanently saved such that if the keypad experiences power failure, the codes are not lost.

The keypad has a timer such that, after 15 seconds of inactivity, the screen will

reset. For example, this will be communicated by the screen going blank if a partial code was entered. If an invalid code is entered, an error message is displayed briefly and the keypad resets. In order to deter brute force guessing of the code, the keypad will initiate a brief cooldown period after several consecutive invalid entries. If the user enters the correct code, the gate system will give a granted access message and send a signal to open the gate.

If a correct code is entered and accepted but the gate does not open, it will be the user's directive to notify the correct personnel. This is because the keypad only tells the controller when to open, opening/not opening is a failure of the gate control system not the keypad.

5 Constraints

The communication between the gate and the keypad is one way via buried hardline. The keypad needs to work in inclement weather. Therefore, the keypad will be weatherized against wind, rain, snow, and lightning strikes, and will have a persistent system to store the previously three used codes. The keypad needs to work 24/7 so that the users can access the facility at any time. Keypad input is limited to the physical combination of the keypad numbers. Sequence of keys are limited to the 3 code combinations.