UNIVERSITY OF LA VERNE
LA VERNE, CALIFORNIA

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SENIOR PROJECT PROPOSAL

J2 INNOVATIONS' AUTOMATIC RFID EMPLOYEE CLOCKING SYSTEM

A SENIOR PROJECT SUBMITTED TO:

THE FACULTY OF

COMPUTER SCIENCE AND COMPUTER ENGINEERING

IN CANDIDANCY FOR THE DEGREE OF

BACHELORS OF SCIENCE

SOFTWARE / ENGINEERING

BY

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1 Personal background

My name is Koppany Horvath, my major is Computer Science and Computer Engineering at the University of La Verne with concentrations in Software and Engineering. I originally got interested in computer science when I got my first computer at age 14 and wanted to know more after I wrote my first couple hundred programs. I have gotten to the point where most aspects of my life are based on computer science, such as my job and my hobbies. My other hobbies involve electronics, robotics, retro-computing, and watching Star Trek. My current job is as a programmer at J2 Innovations, but prior to that, I was a kitchen knife salesperson.

2 Introduction

Keeping accurate records of employee work times is very important. Not only does it ensure that the employees get paid for what they worked, but it also makes sure that conflicts arising from accidental overpaying or underpaying do not occur. Accurate time records also allow for the possibility of measuring work performance when coupled with descriptions of what was done during those hours. Using this information to modify the working environment and schedules can lead to higher productivity in a company.

3 Organizational overview

The target company for the senior project is J2 Innovations. J2 Innovations is a small software company that was founded by Jason Briggs in 2009 and current has about 20 people working for it. This company specializes in building automation software. The types of automation have to do with controlling HVAC systems and lighting. The software produced at J2 Innovations also records sensors scattered throughout buildings to monitor parameters such as room temperatures or whether the lights are on or off. J2 Innovations has partnerships with companies such as KMC Controls and Siemens. The company has one office in Chino, California, and one office in District 5 of Bucharest, Romania, along with a few remote employees scattered around the world. This project will be made for and deployed in the Chino office.

4 Problem statement

The current system has a few problems that tend to bother the people working at J2 Innovations. The problems are listed below in descending order of severity.

1. The biggest problem that the manager complains about is that the system is a third party service that requires monthly payment which is increased for each new employee using the system, and as such it is also not flexible in terms of adding new features.

2. A problem that the employees don't like is that with the current system employees have to manually type in their starting time and ending time which sometimes results in inaccurate information when an employee can't remember their starting time accurately or decides to report incorrect times.
3. Something that the project manager is annoyed about is that he has no idea what the general schedule is for part time employees who have very dynamic schedules, and the current system has no fast way to see what an employee's usual schedule is.
4. Another minor problem that employees don't like is that they are required to submit a daily email containing their work for the day along with a weekly email containing not only the information from the daily emails, but what their times were for each day that they worked. This is very redundant and a better system would allow the project manager to have a less clouded inbox so as to focus on customer emails.
5. One problem that frustrates employees sometimes is that the current system is sometimes difficult to use and does not always act the way it is expected to act. An example of this is when entering in the ending time, the system attempts to guess if the time is AM or PM and sometimes gets it wrong, leading to the employee time being too much or too little if they don't spot this error and correct it.

5 Scope of the project

The proposed project will utilize both custom made software and custom made hardware to solve the problems detailed above. Specifically, this project will result in the construction of the Radio Frequency Identification (RFID) hardware capable of recording user input events. This project will also result in the development of the software needed to record the input events from the RFID hardware and provide an interface for the users to view, edit, and describe the input events. The software interface will also allow the management position to view the information of employees in order to calculate their hours and paychecks.

6 Description of the current system

The current system used for J2 Innovations' employee clocking system is a third party service called Toggl. This is an online time tracking system for small businesses and can be found at https://toggl.com and is available from $9 per person per month to $49 per person per month. Being web based, it is accessed through a web browser and has no associated hardware with it.

The way an employee uses the system at J2 Innovations is they are invited to join by the manager via an e-mail link. Once they sign up from the link, they then have an account on Toggl that they can use to log their hours and the work that they did.

With that account, an employee can enter their starting time at the beginning of their shift. During their shift, the employee uses the text input field to type in the various activities that they did throughout their shift. At the end of their shift, the employee enters in their ending time and submits all that information to the Toggl server.

Alternatively, due to limitations of the system, a user may record all of this information locally in a text file, and then enter in and submit that information at the end of their shift.

7 Description of the Proposed System

The proposed system to replace the old system is planned to use both software and hardware solutions to make the process as user friendly and convenient for both management and employees. This system will function as a more interactive replacement for the current system.

The initial setup of the system involves installing the software onto a physical or virtual server that is connected to the company's network. Then there is the installation of the RFID hardware at the main doors of the company building. Once the infrastructure is set up, then accounts are made for each employee along with RFID tags if the employee wishes to use the RFID system.

On the employee's side, using this system will be convenient and user friendly. The employee wears the RFID tag wherever convenient, and when walking into and out of the building the employee swipes the tag on the surface of the RFID node. The RFID node will give an audible tone to indicate that the user has been recorded, and the employee can go about their business. During the day or at the end of the day, the employee uses the web interface to record what they have been doing that day. Alternatively, if the employee does not wish to use the RFID system, the user is allowed to record their starting and ending time through the web interface. If at any point the user wishes to edit or view any of their profile or historical data, they can do so through the web interface as well.

As for management, they will be able to view the data from the employees in order to see what they have been doing and to get their hours worked for the week. The web interface for management is expected to have a chart displaying each day of the week with when the employee started, ended, and for how long they worked on that day. This visualization would greatly simplify the process for management.

This proposed system will be able to solve all of the problems detailed in the problem statement section:

1. Since this system runs locally and is not dependent on a third party service, the manager will no longer have to pay for each employee each month. Being a custom made system also gives it the ability to be flexible in terms of features.
2. Because of the RFID hardware, employees will no longer have to manually type in their starting and ending times because that will be automatically recorded.
3. The manager will have a better idea about what the user schedules are because of the graph that will show the employees' times throughout the week.
4. Employees will no longer have to submit their daily emails because all that information will be readily accessible for the manager through the web interface.
5. The web interface will no longer be a problem because the interface will no longer have to try to guess the time for an employee because it will already be handled by the RFID system.

8 Requirements for the proposed system design

The requirements for this system are fairly small. The system will require a Linux server to run on that is connected to the company's network. The RFID nodes will need mounting

hardware to be able to be installed next to the doorways. The RFID nodes will also need an outlet so they can be connected to power, and WiFi access so they can communicate with the server.

9 Implementation plan

The implementation plan is as follows:

1. All requirements will be discussed and coordinated with the project manager in charge of supervising this project.
2. Software will be iteratively developed along with hardware that will be prototyped before creating a final version.
3. All software will be tested extensively using unit tests and integration tests. All hardware will be tested to ensure that it conforms to the requirements.
4. Documentation will be written for both programmers and end users.
5. The project will be set up at the specified company and demonstrated during the final presentation.
6. All documentation and non-physical resources will be submitted for review.

10 Request for support from the company if needed

No support from the University of La Verne Computer Science department is planned to be needed. This includes financial support and use of equipment.

Very little support from the J2 Innovations company is planned to be needed initially. All expenses for materials and equipment will be provided by the student. All software will be developed by the student, although some help may be requested from the higher-level programmers at J2 Innovations if required. All studying and research for this project will be done during the student's own time in order to preserve the time of the company.

One area where support from the company J2 Innovations will be needed is in installation and testing. Once the hardware and software systems are finished, the software will have to be installed on a server and the hardware will have to be mounted near the main doors. Then the employees' help in testing the system will be requested. All that will be expected of the employees is to use the new software system and carry RFID badges in order to interact with the hardware system.

11 Development time frame and cost

Hours Spent:

2018	February				March				April				May					Summary	
Tasks	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	5	Hours	Percent
Studying and specifying requirements		2	4	4	2	1												13	16.88%
Design			1	1	2	2	1											7	9.09%
Implement					1	2	3	3	3	3	2	1						18	23.28%
Unit test & integrate & test							1	1	1	1	1	1	2					8	10.39%
Write user's manual								1	1	1	2	1	1	1	1	1		10	12.99%
Write final report												2	2	4	3	2	2	15	19.48%
Presentation															1	2	3	6	7.79%
Hours		2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	77	100%

Parts Cost:

Part	Cost	Quantity	Total
MFRC522 Arduino RFID Module	$4.99	2	$9.98
ESP32 IOT Board	$10.49	2	$20.98
2-pack 27mm Piezoelectric Disk	$4.59	1	$4.59
10pcs 3A Step Down Power Converter	$4.95	1	$4.95
10 x 3mm Diffused LEDs	$1.89	1	$1.89
		Total	$42.39

12 Primary contact person include

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13 Approvals

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